AMERICAN MACHINIST

A PRACTICAL JOURNAL OF MACHINE CONSTRUCTION

VOLUME 24 NEW YORK AND LONDON NUMBER 7

Published at 218 William St., New York,
Every Thursday by the

American Machinist Press.

[INCORPORATED.]

Also published at 34 Norfolk St., Strand, London, W. C.,
Every Saturday.

Correspondence on mechanical subjects solicited. Name and address must always be given—not necessarily for publication.

Address all business communications to the American Machinist Press. Matter for reading columns may be addressed to the Editor.

Subscribers can have address changed at will. Give old and new addresses. Date on wrapper denotes end of month in which subscription expires.

Subscription Price:

$4 per year, postage prepaid, to any post office in the world. No back numbers beyond current year.
For sale by newsdealers, generally.

Subscription agent for Denmark, Norway and Sweden, V. Lowener, Copenhagen. Subscription agent for Germany, Austria and Holland, Gustav Diechmann & Sohn, Neue Promenade 4, Berlin Subscription agent for Spain, J. F. Villalta, Puertaferrisa, 7-9 Barcelona.

Entered at New York P. O. as mail matter of the second class.

Cable address, "MACHINIST," N. Y.
Lieber's and A B C Codes.

The Neglect of Well-Proven Labor Saving Devices.

Nothing impresses one who goes about among machine shops more than the limited local use of devices of demonstrated value. A device—and often one of wide application—which has so thoroughly "soaked in" to the practice of one shop as to be a matter-of-course method of doing a certain class of work, will be, in another, entirely unknown, or, if known, looked upon as a curiosity of "foreign" practice and of doubtful value. Conversely the second shop may have features which the first could use with equal advantage, but of the merits of which it is ignorant, or, if not ignorant, which it belittles, ignores or condemns through imaginary defects—defects which the briefest inquiry would show to be non-existent.

Of such devices of a strictly shop nature we may mention the draw-in or spring collet chuck. To describe or enlarge upon the usefulness of this chuck would be taken in many shops almost as an insult and at the least as kindergarten instruction, whereas, in others, such an account would be received with the most languid interest if not actual incredulity. In the first shop complete sets of these chucks will be found which the workmen use with the same freedom and familiarity as mandrels or reamers, while in the second shop only a few of the best informed mechanics may know of the chuck at all and with them it has a purely "academic" interest. The first shop would hardly know how to get along without it, while the second, if presented with a complete outfit, would not know how to make use of it.

This condition of things is not, however, confined to the shop, for the drawing office is proportionately just as much of a sinner as the shop. One would fancy that a draftsman, spending his days in inventing, developing and designing labor-saving machinery—and *all* machinery is of that character—would of all men be alive to the advantages of devices to save his own exertions; in fact, the very scarcity of devices for saving the draftman's labor and the supposed superior intelligence and mental alertness of draftsmen as a class, would lead one to expect every draftsman to be familiar with the few that do exist as a matter of course.

And yet how many draftsmen make use of the slide rule? The use of this instrument has, of course, increased enormously in recent years—the writer of this vividly recalls how his attempt to buy his first one involved a search through all the instrument shops of this city, and resulted in the purchase of a battered second-hand instrument as the best to be found—but, according to our observations, the instrument has not yet found its way into many drawing offices. Go to those who do the calculating and other engineering work of a general business or sales office and it is to-day rather the exception to find one without a slide rule on his desk, but drawing offices illustrate again the condition of things which we described at the opening of this article. Here and there one will be found in which the instrument is as much a part of every draftsman's kit as a T-square or a pair of dividers, but in the great majority of such offices the draftsmen are simply in ignorance of the fact that they are neglecting a device which converts drudgery into a pastime—a device which will save a greater percentage of labor than any which most of them can hope to ever devise, while it also does what no other labor-saving machine can do—eliminate drudgery as well as save time.

Perhaps the most striking testimony we have ever heard of the value of this instrument came from one of the older generations of engineers—a man rich in years and honors—who was enlarging upon the superior advantages of young men of the present day, and mentioned as an illustration his astonishment when, for the first time, he ran up against a "slide-rule fellow." The occasion was a consultation over some pumping machinery, and our friend was simply overcome at the manner in which calculations were made, which, with a pencil, would have been a serious matter, but which, with the slide rule, were made off-hand as an incident during the conversation. Of course he magnified the difficulties of learning the use of the instrument, or he would not have given it as an illustration of the advantages possessed by the young men of to-day, but he was not alone in this, as multitudes of these same young men neglect it because they suppose it to be deeply abstruse and difficult to learn.

To one who has experienced the relief from the drudgery of arithmetical calculation which is afforded by the slide rule and the delight that comes from that relief it is simply incomprehensible that so many go on in the old way, wearing out good pencils and spoiling good paper, to say nothing of growing themselves prematurely old and haggard, multiplying, dividing and carrying—and incidentally making mistakes in the process.

All the ordinary calculations of the drawing office may be made with this instrument with a facility and absence of mental effort which no one can appreciate until he has experienced it. Excepting perhaps the bookkeepers' adding machine, there is no other mental labor saver which can approach it in importance or value. The calculations of loads and strains, the determination of pulley sizes and speeds, of the proportions of parts, areas and circumferences of circles, squares and square roots, capacities, horse-powers, steam pressures, port areas, the comparison of machinery of different sizes for capacity and output, to say nothing of that delightful (?) occupation of all draftsmen—the calculation of the weights of complicated castings—are but a few of the every-day operations of the drawing office in which it stands ready to assist all who will allow it to do so. It costs but little, its use is easily acquired, and the draftsman who hasn't the enterprise to get one and learn to use it deserves to be a drudge to the end of his days.

The Billion Dollar Steel Combine.

The air is filled with flying rumors of a billion-dollar consolidation in the steel industry. The basis of such a pooling of interests, according to these reports gen-

erally, will be a purchase of Mr. Carnegie's controlling interest in the Carnegie Company by a J. Pierpont Morgan syndicate. Individuals who would be prominently concerned in such a deal have been acting in a way tending to confirm suspicions that the transaction is in prospect, if not actually closed, but they have steadfastly refused confirmation of the story, until at last E. H. Gary has come out with a conservative confirmation. The stock market had already responded to the hope that the deal will go through. There is no reason to believe that the reports are not correct. Yet the wisdom of suspending judgment is shown by such precedents as the failure to materialize of rumored transfer of control in the Carnegie Company two years ago, and by the statement made last week—with how much truth we do not pretend to say—that the Vickers-Maxim-Cramp deal, which had come to be regarded as a sure thing, has fallen through after all.

Around the nucleus of the Carnegie Company in Morgan's control would, or might, be clustered the other principal steel properties of the country, including the Federal Steel Company, the American Steel and Wire Company, the American Sheet Steel Company, and, perhaps, the National Tube Company. In the scope of this combination would of course be embraced numerous coke, ore and freight transportation holdings. But beyond this billion-dollar steel trust there would naturally be comprehended in its general scheme the immense railroad interests which have gradually been acquired by Morgan and his coadjutors. This consolidation of railways has gone on very rapidly of late and about all the important railroad interests of the country seem to be coming into control of Morgan, Rockefeller and their friends. The result of the movement now on foot has therefore the aspect of a virtual consolidation into one system of all the principal steel and railroad interests, with the Standard Oil and numerous subsidiary industries thrown in. Such an organization would, of course, be utterly without a parallel in the previous history of the world.

It is hard to estimate the results of such an institution. That offensive measures to advance prices and stifle competition would be undertaken, there is reason to doubt, for the men who could bring to pass such a brilliant piece of financiering must be shrewd enough to see that public sentiment, which is even now on the ragged edge of open war with monopolies, would never allow Standard Oil methods to be carried out in the steel market. What was possible in the case of a commodity of such restricted utility as petroleum would not, and could not, be tolerated for a month with regard to the very staff of industry.

That monopolistic ends might be sought to a limited extent without the employment of openly belligerent methods is possible. But such attempts can never muzzle independent production in the steel trade. If the combine could control raw materials it might be otherwise. But to cut off the supply of coke they would have to seize upon all the coal mines, and while it is possible they might control the ore supply for the time being, or even prevent the development of new mining properties in America, their competitors would still have recourse to foreign mines. Pressing affairs to such a critical stage as this, however, is not probably within the plans of the promoters; still less is it within the limits of toleration of the American people.

On the Need of Education of the Judgment in Dealing with Technical Matters.*

BY GEORGE W. DICKIE.

Of all teachable things, the education of the judgment receives the least attention, while its importance is supreme. I do not know of a single university that has a chair of common sense, and in trying to reason out why this so important endowment is not taught I can think of but one reason, and that is the impossibility of finding a man to fill such a chair.

Men in all professions are therefore left to acquire this most important part of their education as they acquire practical experience, and in most cases with as little success.

It is an unfortunate condition with us that we are nearing the end of our work before we realize how important a factor judgment is in all questions of importance that come before us in our everyday experience.

Self-education in the matter of judgment is a life-long mental discipline. One of the most important points in this process is very difficult to deal with, for every time it comes up it involves us in an internal struggle which equally affects our vanity and our ease.

This point consists in the tendency to self-deception in regard to the result we wish for. For anyone who is not brought daily to the necessity of self-correction in regard to this tendency, it is impossible to realize how all-powerful the tendency is, and how unconsciously we all yield to it. How eager we all are to seek for such evidence as may be in favor of what we want the result to be and to disregard any evidence pointing the other way. We receive as friendly that which agrees with our preconceived notions, and resist and dislike that which opposes them.

In fact, the inclinations we exhibit to receive and to act upon any report or opinion that harmonizes with our preconceived notions can be compared, in degree, only with the incredulity we entertain toward everything that opposes them. And all this goes on unconsciously, while we honestly believe that our judgment is entirely free and unbiased.

It is my purpose to try, in as simple and direct language as I am able to use, to point some of the ways in which we fail to exhibit sound judgment in dealing with the engineering problems that confront us every day.

In my work, how do I suffer from lack of judgment on the part of myself and those connected with me, and how could much of that suffering be avoided, thereby reaching results with less waste of labor and time? This is an inquiry worth making, even if the answer be not quite satisfactory.

There is fast growing up a system which, if I understand the direction in which it is moving, proposes to dispense with the necessity for the exercise of judgment in dealing with everyday engineering problems. Young men without experience, and who have never had the chance to acquire an educated judgment, are, as a rule, put in charge of very important work, and a set of instructions is provided for their guidance, which instructions are supposed, if rightly carried out, to obviate the necessity for any exercise of judgment on the part of the person in charge.

Those of us who are carrying out large contracts with the government and with some public companies find it hardly possible to get anything decided by sound judgment based on experience. I have often tried to reason from my own experience with young inspectors of work, but that kind of reasoning is not now admissible. Printed instructions are produced, with the intimation that these must be adhered to in every particular, the inspector having no discretion in the matter. I have often traced these printed instructions back to their source, and found the author to be a man whom I would not like to trust with doing the work covered by them.

In mechanical engineering and kindred business, such as shipbuilding, the great bulk of the designing is done by the contractor, all working plans being prepared by him. He is also held responsible for the result; yet all his plans must be submitted to a young and, from the very nature of the case, inexperienced inspector, who, however clever he may be in solving theoretical questions relating to the device in question, has never had to make those things himself and to be responsible for their working after being made, and for their costing no more than he said they would cost before he began.

Now, the young inspector reads in his book of instructions, generally in a preface, that the object of printing these instructions is for the proper protection of the interests of the government.

In a decision by the Judge Advocate of the United States Navy, I read the other

*Read before the Technical Society of the Pacific Coast December 7, 1900.

day that the aim and intent of the wording of the specifications and contract for the building of a warship were solely to protect the interests of the government.

Now, my idea has always been that the object of the specifications and contract, when fully carried out, was to produce the best possible warship of the kind specified; that there were two parties to the contract, and that the interests of one needed protection just as much as the other. The language used in the decision mentioned shows how difficult it is for an inspector to use sound judgment, even if he has it at his command. When a plan is presented to him by which you propose to carry out the object of the specification, he looks at it with the distrusting notion in his mind that you have used what skill you possess to design this part of the work as cheaply as possible, and that it is his business to stand between you and the object of your desire; and he will not reason with you as to the why and wherefore of your design without putting you on the defensive in regard to your own character instead of that of your design. And when he has found out where he can add something to your design, to increase its cost without spoiling it, he is very likely to do so, as he thereby tickles his own vanity by impressing you with his power, and cuts you out of doing the thing with the simplicity and economy that you were planning for.

This shows the need of an educated judgment on the part of such an inspector. And of course it might be the other way. The contractor, in making his design, may allow his self-interest to rob him of all sound judgment, and his desire for a simple and cheap device may lead him into making something that would not properly meet the requirements of his contract. What is needed is an honest endeavor on both sides to cultivate the growth of a sound judgment that can decide technical questions altogether apart from the personal interests of the parties.

In no question is sound judgment, based on long experience, more necessary than in the many disputes that arise regarding workmanship and material. Here, where an educated judgment is most required, we find that self-interest and hard and fast rules interfere most with its application. When I look back over the many battles I have had with inspectors who demanded their pound of flesh when it could not possibly be got without blood—sometimes all the judgment lacking on the one side, and sometimes on the other—I wonder why we should continue beating the air over questions that with the exercise of a small amount of sound judgment would never be raised.

A good many years ago, while in the casting yard one morning, I noticed a propeller casting, a solid cast wheel, which has, as many of them are apt to have, some gas checks across the back. I did not consider that the small defect should be any reason for condemning the casting. That was my judgment. Perhaps I was assisted in forming this judgment by a strong desire to save the cost of another casting. When the superintending engineer of the company for which this wheel was made saw the casting, he promptly condemned it, and no amount of reasoning on my part could alter his judgment. There being no desire on his part to help his judgment to concur with mine, he would take no chances with a wheel having any visible defect. And he believed that my opinion was formed entirely on self-interest, while his was founded on the high plane of engineering prudence.

In this particular case I thought it worth while to test the foundation upon which each of us based our judgment. So I said to him, "Your company pays for this wheel 9 cents per pound, and it costs my company 6 cents. If I make another, we will lose 3 cents per pound instead of making 3 cents per pound. Now, I think that I am right in claiming that the slight defect in this casting is no ground for condemnation, but in order to save actual loss your company can have the present wheel for 6 cents per pound."

"Well," said he, "now you're talking reasonably. I will see our people about it and let you know." Within an hour this wheel was accepted and went into service, and, so far as I know, had a long and useful life.

Now, I myself might have acted just as this engineer did, but the transaction illustrates how much we are all influenced by our own desires in these questions instead of by sound judgment, and how difficult it is to know when the decision is prompted by desire when we think we are exercising our judgment. Our whole modern method of testing and inspecting materials is founded on the belief that the faculty of judgment in an inspector is a dangerous thing, and that all excuse for its cultivation must be eliminated from his mental stock in trade.

The other day I saw condemned and broken up a large bronze casting that had cost about $3,000, because the coupons or test pieces showed less tensile strength than the specifications required. The casting itself was perfectly sound and very tough; in fact, admirably suited for the purpose for which it was made, and not the slightest doubt of its character was expressed by anyone who saw it. Yet, because the test piece was required to show 55,000 pounds tensile strength per sectional inch and broke at 44,000 pounds, a great deal of labor and costly material was deliberately destroyed, the inspector claiming that he had no discretion, which means no judgment, to exercise; and when the case was appealed to a higher authority, that authority, who could not see this good piece of work, entirely suited for its place in the structure and with ample margin of strength, simply sent to

(*Concluded on page* 184.)

Commercial Review.

NEW YORK, Saturday, February 9.

MACHINE-TOOL MARKET.

The situation is mixed and on the average shows no particular change from former reports. The head of one local selling firm which represents some of the most prosperous of the Western tool builders pronounces trade still above normal. We are not prepared to say that for the majority of manufacturers of the better class this may not be true as regards the domestic market. The amount of business in the country seems still creditable to prosperous times. The slump in exports, however, is being keenly felt by many. How could it be otherwise in such cases as that of a certain chuck maker who asserts that 75 per cent. of his product used to be shipped abroad? A tendency to accumulate stock or to go on short time is the result, but it would be difficult to say just how large a proportion of manufacturers have had to yield to this tendency. One of the largest Eastern concerns is said now to be working on eight hours' time. The market for heavy tools is apparently better than that for light ones. Orders that have come to one office within the last few days for an 84 and a 64-inch planer, two 38-inch triple-geared lathes, some radial drills, etc., are an illustration of the business being done.

The condition of values is perhaps not so bad as some forms of expression that we have heretofore heard would indicate. It is almost impossible to put one's finger upon an actual official reduction. Some concerns are certainly willing to make close prices in order to get business, while others decline to unbend a dollar's worth. Quite lately one firm refused to give 2 per cent. discount for cash in 10 days. Before a great while the relative status of production and absorption will probably stand out more clearly and the condition of the market will become less puzzling. We have insufficient evidence to state that a break in values is imminent or that a necessity of readjustment is approaching.

It was reported yesterday that orders for some of the special tools for the Rock Island Arsenal had been given out, but the contracts for the milling machines had not yet been awarded. The time limit upon the acceptance of estimates for the British Westinghouse equipment expires about the end of this week. A representative of one of the English firms handling the product of American tool builders who has recently arrived in this country, is said to have come to follow up this transaction. The same rumor was set afloat regarding such a representative who came here several weeks ago. Beside these, at least two other gentlemen of similar connections have visited this country of late, but we do not know that their trips have any relation to the Westinghouse matter. Specifications for a quantity of machine

tools for the shops which the Central Railroad of New Jersey is erecting at Elizabethport, N. J., have been issued by Geo. Hill, 150 Fifth avenue, New York, who is engineer for the enterprise.

MACHINERY EXPORTS FOR 1900.

Accompanying this article is a table showing the exports of machinery of domestic manufacture from the United States for the fiscal year 1900, compared with the two previous years, as well as for the month of December, given as nearly complete as the laws governing the labeling of goods shipped abroad enable the Treasury Department officials to compile the statistics. It will be seen that the total exports amounted for the year to $56,228,101, against $48,929,027 for 1899 and $40,598,724 for 1898. This shows a gain of 15 per cent. over 1899. The shipments at the end of the year did not quite hold their own with 1899, for December shows a slight falling off, but the decrease in the foreign demand for metal-working machinery more than accounts for this, so that were the class named left out of consideration the average of the others would have shown a trifling gain for the month.

It was a foregone conclusion that metal-working machinery exports would not make as good a showing for the year just closed as for 1899, yet the shipments in all but the last part of 1900 were so heavy that the total is $6,210,594, as compared with $6,840,924 for 1899.

CHICAGO MACHINERY MARKET.

Inquiries for power, ranging from 400 to 1,000 horse-power, are a feature of the present trade in the West. Various directorates held annual meetings in January at which resolutions were passed authorizing an enlargement of facilities. Accordingly the inquiries for the necessary power are getting into the trade in quite a considerable number. Some makers are unable to sell on account of the early deliveries asked. One Ohio manufacturer of engines says their shops are sold up for from eight to ten months and that prospective buyers want shipments made early this spring. The common report is that for both engines and boilers there is much more business in sight than for some time past.

Neither is there any lack of inquiries for larger units for electric-railway work. There are inquiries from Nashville for three units aggregating about 10,000 horse-power. The Aurora, Wheaton & Chicago Electric Railway Company is in the market for three engines of 2,250 horse-power each.

Perhaps the final act in the industrial history of the Siemens & Halske plant, formerly the Grant Locomotive Works, near Chicago, purchased by the General Electric Company, was the recent sale of the large machine tools of the plant commercially valued at about $60,000. The Niles Tool Works were the purchasers.

A BUSINESS MEN'S TRIP TO THE SOUTH REPORTED BY THE "AMERICAN MACHINIST'S" CINCINNATI CORRESPONDENT.

KNOXVILLE, TENN., February 7.

It is but a comparatively short time since the great manufacturing centers turned any serious attention to the South as a legitimate field of trade. The party that is now speeding over the lines of the Southern Railway Company in a special train, through the courtesy of President Samuel Spencer, and Mr. D. A. Tompkins, of Charlotte, N. C., an engineer, who has seen unlimited possibilities in his native Southland and through his wide acquaintance and his arguments before the large business bodies of the machinery-producing centers, brought the attention of producers thereto, is made up of men whose individualities are certain to bring about results mutually profitable. Mr. Tompkins recently in a speech before the manufacturers of Cincinnati showed how the South is producing many articles of manufacture required by the territory of the Ohio and the country north and west of it. The list includes cotton cloth, pig iron, cotton-seed oil, lumber, cotton-seed hulls and cotton-seed meal and others. In return he showed what a field the South opens up for the products of Ohio and the Central States in machinery-making lines especially. These would comprise cotton-seed oil machinery, steam engines, machine tools, wood-working machinery, pumps, boilers and the like.

The purpose of the trip is therefore to bring about a better acquaintance among the manufacturers and business men of the two sections. Such men as President George Bullock, of the Bullock Electric Manufacturing Company and Cincinnati Edison Electric Company; J. N. Vaile, president of the Stillwell-Bierce & Smith-Vaile Company, Dayton, Ohio; Thomas P. Egan, president of the Fay-Egan Company, Cincinnati; John A. Church, president of the Cincinnati Cordage and Paper Company, and the Business Men's Club, Cincinnati—such as these compose the party which will visit by easy stages Asheville, Gaffney, Gastonia, Charlotte, Charleston, Columbia, Augusta, Macon and Columbus, Ga.; Birmingham, Mobile, Atlanta and Chattanooga.

An interesting member is Mr. Francis E. Rainey, importer of American machinery with headquarters in London, England. Mr. Rainey will place some large orders ere he returns to England for vertical engines, motors and generators, etc. Mr. Rainey concedes the superior value of electric-power machinery and is particularly interested in studying the various types of cotton and woolen goods machinery, so many examples of which are encountered in this trip through Tennessee, North Carolina, Georgia, Alabama, and South Carolina.

There are at the present time about one hundred mills either under construction, incorporated, organized or in process of organization in towns on or tributary to the Southern Railway.

Mr. Rainey, the English guest, is particularly impressed with the possibilities —"unlimited" he expresses it—for great returns through utilization of the by-products of the Alabama industries. Rumors of deals running into the hundred thousands, involving the sale of engines and electrical machinery are already heard, and but one city in the itinerary has been visited.

The travelers were guests to-day of the Knoxville Chamber of Commerce and the Cumberland Club. They were shown through the great plant of the Knoxville Woolen Mills, the great marble works and others.

President Bullock, of the Bullock Electric Manufacturing Company, was an interested investigator of the remarkable phenomena presented in the confluence of the French Broad and Holston rivers—suggesting a power that would be of incalculable profit were it harnessed like the great Niagara.

Machinery, Machines, and Parts of—	December— 1899 Number.	December— 1899 Dollars.	December— 1900 Number.	December— 1900 Dollars.	The Year— 1898 Number.	The Year— 1898 Dollars.	The Year— 1899 Number.	The Year— 1899 Dollars.	The Year— 1900 Number.	The Year— 1900 Dollars.
Cash Registers	....	51,274	1309	107,663	....	*	....	*418,036	....	860,622
Electrical	....	387,852	...	328,916	....	2,523,644	....	3,145,838	....	5,286,224
Laundry Machines	....	34,933	....	33,553	....	*	....	*182,832	....	475,952
Metal-working	....	748,054	....	355,416	....	5,741,750	....	6,840,924	....	6,210,594
Printing Presses, and parts of	....	115,024	....	158,100	....	843,688	....	1,037,644	....	1,295,379
Pumps and Pumping Machinery	....	304,536	....	177,733	....	2,300,811	....	3,016,645	....	2,750,312
Sewing Machines, and parts of	....	415,281	....	336,266	....	3,062,471	....	4,103,828	....	4,510,221
Shoe Machinery	....	85,333	....	71,884	....	930,671	....	961,736	....	1,028,257
Steam Engines, and parts of—										
Fire	....	.....	....	.....	7	6,588	4	21,848	13	24,625
Locomotive	22	223,500	43	408,615	576	5,190,782	484	4,767,850	436	4,468,527
Stationary	66	38,912	77	111,600	522	352,668	872	494,939	1273	873,500
Boilers and parts of Engines	....	134,798	....	104,007	....	1,145,508	....	1,439,363	....	1,855,398
Typewriting Machines, & parts of	....	243,245	....	232,047	....	2,077,250	....	2,776,363	....	2,730,435
All other Machinery, and parts of	....	1,949,033	....	1,967,851	....	16,413,893	....	19,721,191	....	23,852,046
Total Machinery and parts of	....	4,732,375	....	4,393,651	....	40,598,724	....	48,929,027	....	56,228,101

* Not separately stated prior to July, 1899.

UNITED STATES OFFICIAL STATISTICS OF MACHINERY OF DOMESTIC MANUFACTURE EXPORTED IN THE CALENDAR YEAR 1900.

The Economy of the Steam Turbine —Particulars of Large Sizes— Shop Methods of Balancing Rotating Parts for Extremely High Speeds.*

BY FRANCIS HODGKINSON.

A jet of steam issuing through a properly constructed orifice has as much energy as the same steam performing high ratios of expansion behind a piston. In both cases the work to be theoretically abstracted from a given weight is the same; however, there are some practical reasons for expecting better results in the case of the turbine.

In the design of a three or four-stage compound condensing reciprocating engine it is found that there is no gain in economy by expanding the steam in the low-pressure cylinder beyond a terminal pressure of about 5 or 6 pounds absolute. To do so involves a large increase in the volume of the low-pressure cylinder, thus increasing the friction of the engine and the weight of the reciprocating parts. Moreover, the temperature of saturated steam, as these low-pressures are reached, falls off rapidly, hence there are greater losses from condensation and re-evaporation than gains from the more complete expansion. In the steam turbine no such limits exist. The extra volume of the low-pressure end does not add to the friction. The temperature conditions from end to end remain always the same, and hence losses from condensation and re-evaporation are not in evidence.

Turbines are constructed to utilize the energy of the steam down to the utmost limit. A condensing steam turbine, when in operation, affords a striking example of the conversion of heat into energy. The temperature of the walls of the cylinder at the high-pressure end, about 365 degrees Fahr., falls in the distance of three or four feet, to a temperature of about 126 degrees Fahr. at the low-pressure end.

The diagram, Fig. 1, shows some economy curves developed from tests made on one of the 300-kilowatt turbines now in operation at the Westinghouse Air Brake Company's Works. The results may be summarized as follows:

Full load, 16.4 pounds steam per electrical horse-power hour; three-quarter load, 17 pounds per electrical horse-power hour; half-load, 18.2 pounds steam per electrical horse-power hour; quarter-load, 22 pounds steam per electrical horse-power hour; running light, 750 pounds per hour; vacuum, 26 to 27 inches; boiler pressure, 125 pounds per square inch; revolutions per minute, 3,600.

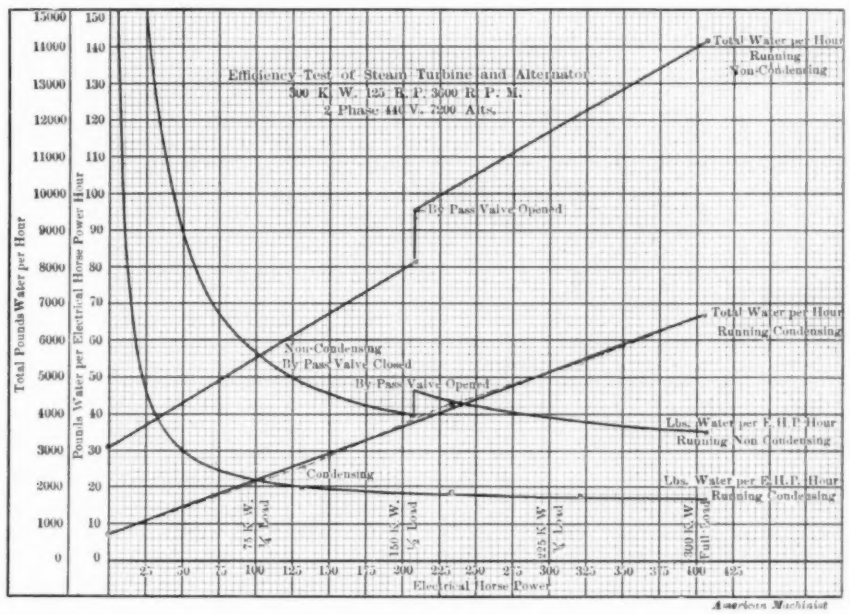

Efficiency Test of Steam Turbine and Alternator
300 K. W. 125 R. P. 3600 R. P. M.
2 Phase 440 V. 7200 Alts.
Total Water per Hour Running Non-Condensing
By-Pass Valve Opened
Total Water per Hour Running Condensing
Non-Condensing By-Pass Valve Closed
By-Pass Valve Opened
Lbs. Water per E. H. P. Hour Running Non Condensing
Condensing
Lbs. Water per E. H. P. Hour Running Condensing
75 K. W. ¼ Load
150 K. W. ½ Load
225 K. W. ¾ Load
300 K. W. Full Load
Total Pounds Water per Hour
Pounds Water per Electrical Horse Power Hour
Electrical Horse Power
American Machinist

FIG. 1. RESULTS OF AN EFFICIENCY TEST OF A STEAM TURBINE AND ALTERNATOR.

The consumption of 16.4 pounds at full load is in itself remarkable, but such results as that at the light loads have never been approached before. It may be said that the consumption at half-load is only 10 to 12 per cent. greater than at full speed.

It must not be lost sight of that these results are per electrical horse-power. It is usually the custom of engine builders to publish their results per indicated horse-power, which means very little to the power user. He is chiefly interested in the economy of steam per unit of power he gets out of his power plant, not the steam per unit of power he has put into it.

To make a comparison with a reciprocating engine, assume the efficiency of transmission from the steam cylinders to the switchboard to be 85 per cent., which is about the very highest attainable. This would bring the full load water rate on the turbine just described to 14 pounds per indicated horse-power. The tests were made under ordinary conditions so far as dryness of steam is concerned, the boilers being some distance away, and no allowance was made for wetness of steam.

On the diagram a set of lines is given which show the efficiency when running non-condensing. These results are somewhat inferior because of this particular turbine having been designed to run condensing. Nevertheless, the results are not so bad as to preclude its being operated under these conditions, should at any time the condenser be out of order. A turbine designed for running non-condensing gives proportionately as good results as the condensing curves shown on the diagram.

By this set of curves may be observed the function of the by-pass valve. When running non-condensing the by-pass valve remained closed until about half-load was reached. Upon being opened the efficiency fell off, as shown, and continued to improve from there on as the load increased. The overload capacity of the engine is

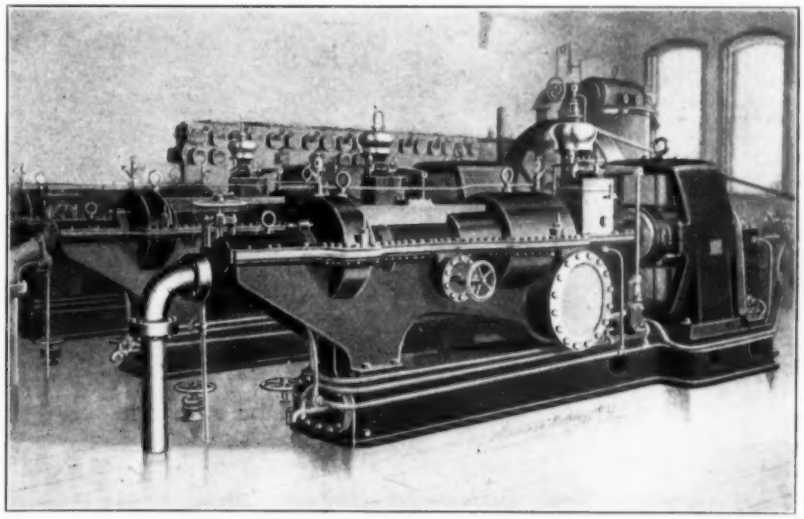


FIG. 2. STEAM TURBINES AND GENERATORS AT THE WESTINGHOUSE AIR-BRAKE WORKS.

* Extracted from a paper read before the Engineers' Society of Western Pennsylvania

obviously more flexible than that of most engines.

Superheating may be made use of with considerable gain in economy and without the usual difficulties. There are no internal rubbing surfaces and no packing glands to become injured by the high temperature; 60 to 70 degrees of superheat improves the economy by some 20 per cent. In this connection Prof. Thurston has lately recorded some experiments with a De Laval turbine. For every 3 degrees Fahr. of superheat 1 per cent. gain in economy was obtained. With 37 degrees of superheat the capacity of the turbine was doubled. This gain he attributes almost entirely to the reduction of skin friction.

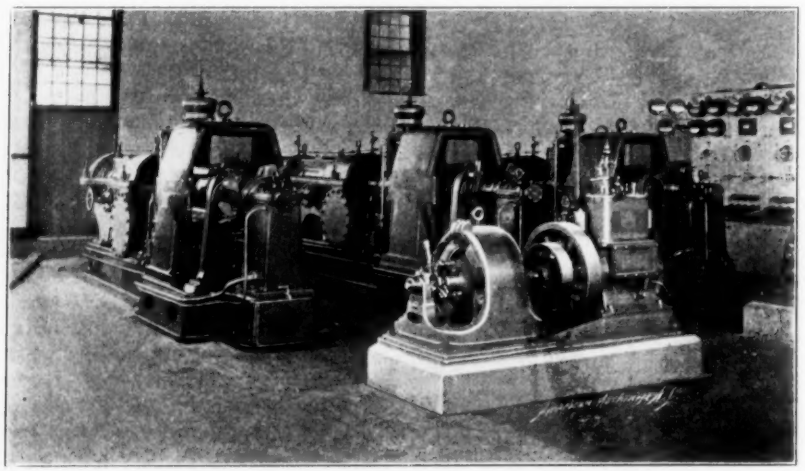


FIG. 3. ANOTHER VIEW OF THE PLANT SHOWN IN FIG. 2.

Figs. 2 and 3 show views of a power plant at the works of the Westinghouse Air Brake Company. In the foreground of Fig. 3 may be seen the 10 horse-power exciter engines and generators, and their size, compared with the 500 horse-power steam turbines. The whole outfit of three turbines and generators, aggregating 1,500 hor-e-power, occupies a floor space of 24 feet square, and allows ample room for access to the turbines. The total weight is about 25,000 pounds each; length, 19 feet; width, 4 feet 3 inches.

Recently a 1,000 kilowatt outfit was built by C. A. Parsons & Co. for the Elberfeld Corporation, in Germany. At 1,200 kilowatts, 130 pounds boiler pressure, 18 degrees Fahr. of superheat, the turbine driving its own air pump, etc., an electrical horse-power was produced for 14,025 pounds of water per hour. This is probably the highest economy ever obtained in any steam engine.

Fig. 4 shows the complete revolving part of a 3,000 horse-power turbine. Its weight is 28,000 pounds; length over all, 19 feet 8 inches; distance between bearings, 12 feet 3 inches; largest diameter, 6 feet. The turbine of which this forms a part is shown in Fig. 5, and is being set up in the power-house of the Hartford Electric Light Company. It is direct-connected to a 1,500-kilowatt generator, the total outfit having the following dimensions: Length, 33 feet 3 inches; width, 8 feet 9 inches; total weight, including generator, 175,000 pounds. This is the largest steam turbine in one integral part ever built.

As there are no rubbing surfaces in the turbine no internal lubrication is necessary. This enables surface condensers to be employed and the condensed water to be used for boiler feed without fear of getting grease into the boilers. The turbine is entirely automatic in all its functions, and requires remarkably little attention. The only real working part is the spindle revolving in its bearings. These bearings are found to wear but little, if at all, and the cost of renewals and repairs is very small. In 1897 the Newcastle & District Electric Lighting Company published their costs in this regard. The power-house contained eleven turbines of 75 to 150 kilowatts each. The cost for repairs and renewals amounted to 26 cents per kilowatt per annum, including all repairs to boilers, turbines, condensers, pumps, generators, cables, fittings, etc.

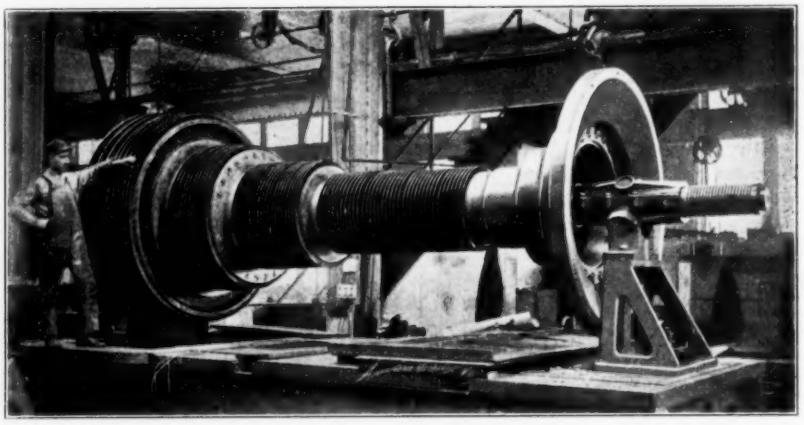


FIG. 4. REVOLVING PART OF A 3,000 HORSE-POWER STEAM TURBINE.

By reason of the turbine making use of the last available expansion of the steam there is considerable advantage in employing the highest vacuum. For instance, considering the 300-kilowatt turbines described, and assuming the steam consumption with 27 inches vacuum to be 16.35 pounds per electrical horse-power, it may be reasoned from a thermodynamic basis that with the same machine designed for 25 inches vacuum the consumption would be 18 pounds per electrical horse-power hour. On the other hand, by designing the same turbine to suit an exhaust pressure of one-thirtieth of an atmosphere, or say 29 inches vacuum, the consumption would come down to 14.12 pounds per electrical horse-power hour.

The applications of steam turbines are perhaps not so universal as those of ordinary steam engines. They are preeminently suitable for driving electrical machinery, particularly alternating current dynamos. Some difficulties are, however, experienced with the commutation of continuous current generators of fairly large powers.

There is nothing remarkable in the design of generators for this purpose, except the modification necessitated by the high speed. For this reason they are remarkable for their small weight and dimensions and the absence of crowded pole-pieces.

Builders of electrical machinery have for some years been working in the direction of reducing speeds from the old belt-driven rigs to admit of direct-connection to slow-going reciprocating engines. The condition for steam turbines is, however, a step in the reverse direction. Turbines have been used with good success in England for fans and blowers.

Although the type of bearing employed is capable of successfully dealing with about any reasonable error in balance, at the same time it is very essential that the revolving parts be very accurately balanced, in order that the collector rings and commutators may run true, and that the clearance between the tips of blades and walls of the turbine cylinder may be maintained as fine as possible. Consequently balancing forms quite an import-

ant feature of the construction and has many interesting features. The usual method of balancing, which consists of rolling the piece on some ways and thus locating the heavy side, is sufficiently accurate for ordinary slow-speed work, but no degree of real accuracy can thus be attained.

The attempt to balance such a body as is generally of the nature of a long cylinder with a journal at both ends. The only way to do this balancing is to deliberately mount it on bearings which are preferably set on springs and running it up to speed by belt or any available means. While running, it is marked with a colored pencil at different points which serve to indicate where to add weight.

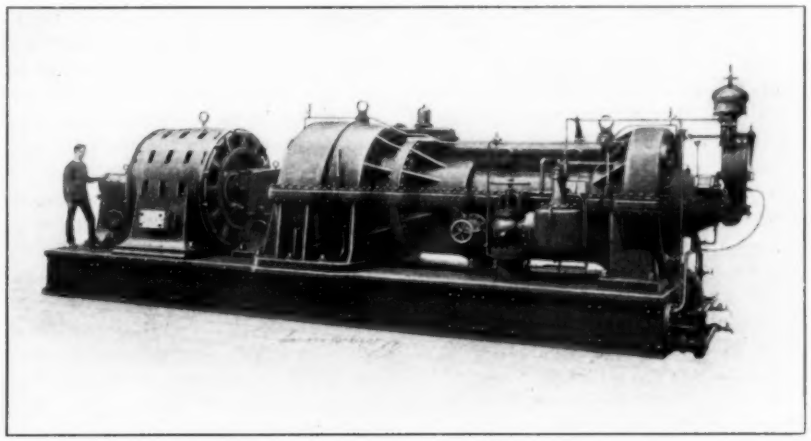


FIG. 5. 3,000 HORSE-POWER TURBINE AND GENERATOR.

the above by such methods, might result in a heavy spot at two opposite sides and two opposite ends, giving a standing but not a running balance. It is therefore found desirable to split the body up into comparatively narrow rings and balance each separately, which process renders the above error negligible. For balancing such rings the Westinghouse Machine Company has devised a machine which performs the work with remarkable accuracy. It is shown in Fig. 6, which shows a ring in place on the turntable. The turntable is pivoted on a beam which is in turn hung on two knife edges. Below the turntable is rigidly attached an adjustable counterweight. The turntable, of course, is free to turn independently of all this. Means are provided for sliding the whole turntable and counterweight on the beam and in a direction at right angles to the line of the knife edges.

The counterweight is adjusted to bring the combined center of gravity in a plane close to the knife edges. Then by sliding the mass on the beam the table may be made to rest horizontally. Then by giving the turntable one-half revolution, the table will fall over by twice the amount it is out of balance. Readings are taken in two opposite directions and the exact location and the amount of the error may be immediately figured.

Balancing by this method may be done very rapidly and with surprising accuracy. A ring weighing 6,000 pounds has been balanced within 2 ounces and rings weighing 200 or 300 pounds within ⅛ ounce.

In the case, however, of the revolving parts of electric generators the final winding, etc., is liable to throw it out of balance, and then there is no alternative, but to balance it in its entirety. The shape

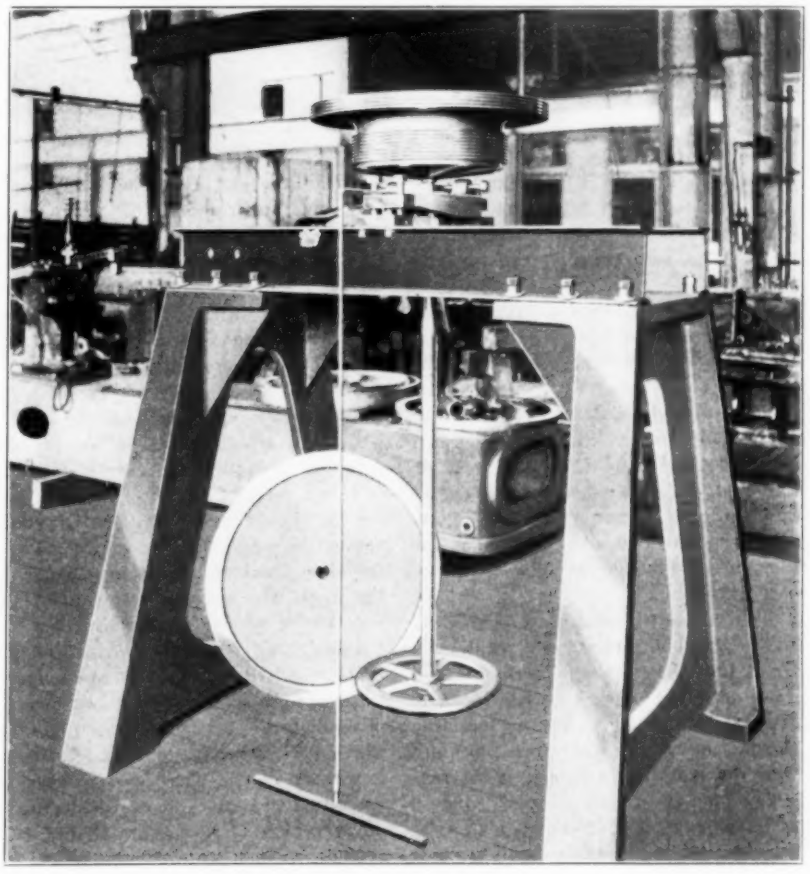


FIG. 6. MACHINE FOR ACCURATELY BALANCING REVOLVING PIECES.

With a small body revolving at 5,000 or more revolutions per minute, the light side is always the one that comes outward, so that weight should be added just where the marks come. In some cases the marks are opposite at each end, when weight needs to be added on one side at one end and on the other side at the other end. These facts show that when the high speeds are reached a body ceases to revolve on its geometric axis and takes its axis of gravity.

On its way up to speed there is generally some point at which there is considerable vibration. This is termed the critical speed and seems to come at the time when the body is changing its axis of revolution. These critical speeds become lower as the bodies are heavier and of greater radius. In the cases of heavier and bigger bodies, which also have a lower rotative speed, the marks do not come just on the light side. They may come sometimes as much as 90 degrees ahead of the light side. The exact angle can only be found by experiment, and at best this is only a cut and try method. With experience, however, work may be put in very accurate balance.

It is generally conceded by engineers that but little more may be anticipated in the development of the reciprocating engine. Any improvement that we can imagine would not very materially improve its efficiency as a heat engine. On the other hand, the turbine is capable of development in many ways, particularly in the use of superheated steam, to a degree hitherto prohibitive, so that the day may not be very far distant when the turbine will replace the reciprocating steam engine for most purposes.

Spoiled Work—Inspection and the Use of Limits Under the Premium Plan.

BY GEO. H. HALL.

Much has already been said in these columns regarding the time-limit system, the principles of which have been clearly set forth. There are, however, several points connected with the detailed workings of the system of which nothing has yet been said. Questions of more or less importance will from time to time arise which must be decided in a manner consistent with the policy, yet without giving undue advantage to either employer or employee. The following cases are given as examples of some of these questions and the manner in which they have, in one shop, been decided.

A fundamental objection to the time-limit or any other premium-paying system is, that as the workman is furnished an incentive to hurry, he is more likely to slight the work or to make mistakes. This creates a demand, on the part of the employer, for an inspection of the work before the premiums are paid. In small shops where the amount of work is not very great, this inspection can be attended to by the foreman, or, in some cases, it is possible for the jigs and fixtures employed for the successive operations to be so constructed that the work cannot be placed in position for an operation until all previous operations on the piece have been properly performed. If the amount of work be sufficient to warrant, an inspection department should be established and all work be passed through this department.

The inspection department has its advocates and its opponents, but used in connection with the premium plan it will be found to more than pay for itself. As the work is inspected by detail, many errors are detected and remedied, which, if passed unnoticed, would have caused the rejection of the finished work. After all is said for and against detail inspection, no one can deny that the principle is the correct one—"First be sure you are right, *then* go ahead."

If the work is to be inspected in detail, the premium contract should contain a clause to the effect that no premiums will be paid until the work has satisfactorily passed inspection. This clause refers only to the premiums and therefore does not prevent the workman's receiving his regular day pay at the accustomed time in case his work is not completed in time to be inspected before the payroll is made up.

In accepting or rejecting work under the premium plan, the following regulations provide for the cases which are likely to arise. If the work is all right, it is passed by the inspector and the man is paid the full premium to which he is entitled by the terms of the agreement. If work be rejected for causes which can be remedied (such, for instance, as a hole being left too small or a turned piece too large), it is returned to the workman and by him made right. The time spent in thus rectifying rejected work is added to that already spent on the work, thus reducing the time for which the premium is paid.

If the work is spoiled so as to necessitate its complete rejection, the workman should receive no pay for the work. When the plan is applied to more than one piece, this rule is applied as follows: The time and premium are first figured for the whole number of pieces, as if all had been correct. This, divided by the number of pieces, gives the deduction per piece, thus providing a pro rata deduction of his premium as well as his day pay. Example: Given 100 pieces at a time limit of ½ hour each, or a total limit of 50 hours. The workman consumes 30 hours, for which he receives 25 cents per hour = $7.50. He saves under his limit 20 hours = $2.00, making his pay for the job, provided all pieces pass inspection, $9.50, or 9½ cents per piece. If on inspection it is found that ten of the pieces are spoiled, then from the $9.50 otherwise due him, 95 cents is deducted, making his pay for the entire work $8.55.

This deduction of pay for work spoiled under this system is questioned by some on the ground that the men do not intentionally spoil the work and therefore should not be "docked" on premium work when they are not on day work. The fact is, however, that the men working for premiums are bound to hurry the work and to take greater risks with it than they otherwise would. If, as a result of taking greater risks, the man is able to save on his time, he reaps the reward therefor, so that it is only just that, if by over-exertions he spoils his work, he should be the one to stand the loss, especially as the employer has to lose the stock and all work put in the pieces by previous workmen.

There is also another class of work which should be most closely guarded against in order that the entire morale of the shop shall not be destroyed. This is the work which, though not correct, may yet be used under certain conditions. Pieces turned small may be utilized if the holes which they are to fit are made correspondingly small, while other pieces can be made large to accommodate holes which are made over-size. The employment of any work in this class is, of course, poor practice, and on general principles any work which is not right should be rejected. When interchangeability is of vital importance this second-class work cannot be considered. In other cases, where such work can be used, it would be unjust to the workman to refuse payment for it. It would be equally unjust to the employer himself to pay *in full* for it, and the influence of such a course on the shop would be dangerous. Provision must therefore be made for work which is passed as second class. In paying for this class of work, we first figure the time as if all pieces were accepted, then for the pieces passed second class we make a deduction equal to one-half the amount which would have been deducted had they been rejected. Thus, in the example, had the ten pieces, instead of being rejected, been passed second class, the deduction would have been 47½ cents and the payment for the work $9.02½.

It will be seen at a glance that the introduction of detailed inspection will afford unlimited opportunity for disagreement between the inspection department and the workmen regarding the limit of variation from perfect which should be allowed to pass in pection. Perfect work cannot be expected, and it should be the policy to allow as wide a limit as is consistent with the degree of accuracy required in the finished work.

What this limit can be should be determined previous to the commencement of the work, so that the workman knows at the start just what is expected of him, and there simply remains for the inspector to pass or reject in accordance with the fixed limits. The limits should appear upon the drawings as dimensions, except that instead of giving one figure as a working dimension two figures are given. If, for example, we are making a shaft to run in a standard hole 2 inches in diameter, we may conclude that about .0025 inch would be the proper amount of play to make a good running fit. We consider that we should have a looseness in all cases of at least .002 inch, while if it were .003 inch the fit would still be considered suitable. So as .001 inch is a reasonable allowance to make for ground work, we would write the dimension for the diameter of the shaft $\frac{1.997}{1.998}$. This dimension is applied to a ground surface. Now, if the work is being done in a time limit, it will be found that the man turning the work for grinding and the man doing the grinding hold very different opinions as to the amount of stock which should be left on a turned piece for the grinder to remove. Work which is turned in proper manner should not contain tool marks more than .001 inch deep, so that a minimum amount of stock which should be allowed for grinding would be .002 inch on diameter, so that we may set as a minimum turning diameter for the piece above considered 1.998 + .002 = 2.000. As .003 inch is a very liberal limit for good turning, we may set our maximum limit this amount above our minimum limit. Our work should therefore be marked with two sets of dimensions, thus: Turn $\frac{2.000}{2.003}$, grind $\frac{1.997}{1.998}$.

With this system there is no chance for a question as to the correctness of the work. It is either inside or outside of the limits, and for the inspector there is but one course open, while the workman has no ground for complaint, as he knows

at the start just what is expected of him.

If there is then any question as to the possibility of passing any of the rejected pieces as second class, this should be decided by the superintendent.

The premium system very conveniently accommodates itself to the case of two or more men working upon the same job, as a continuous job upon which a night and day man are employed. A limit of, say, 80 hours is given on a job. A works 30 hours and B 20 hours; then the premium for the 30 hours saved would be paid in direct proportion to the time spent by each upon the work—*i. e.*, A would receive a premium for 18 hours and B for 12 hours. If, however, in addition to the 80 hours actually allowed for the work, an allowance had been made for setting up the job and getting out tools, the whole of this allowance would have been given to the one doing that part of the work. If the above limit had read "80 hours for the work, 10 hours for tools," and A had taken out the tools and started the job, then his premium would have been 28 hours instead of 18.

In the case of small pieces being done by "shifts," the work of each man is kept and inspected separately, exactly as if they were independent jobs, save that when an allowance is made for tools, the whole benefit of this allowance is given to the man starting the job.

Casting a Tangye Engine Bed.

BY R. H. PALMER.

Fig. 1 shows a Tangye engine bed in the machine shop. An improvised planer rig is working out the pillow block. We are to tell here only about making the casting. Fig. 2 is a side of the pattern, and Fig. 3 is the inside of the pattern, looking down into it as it lies bedded in the floor. Fig. 4 shows the mold, split lengthwise through the main core. Fig. 5 is in the foundry, the cope lifted off and supported on the farther side of the mold. Fig. 6 is the mold with fire baskets for drying, and Fig. 7 the same covered with corrugated iron for retaining the heat. Fig. 8 shows the mold ready for coring. The core is conspicuous in the foreground and the cope is at the back to the left, the open mold being seen at the right.

The pit being dug to the required size and depth, binders *A*, Fig. 4, are bedded in across the bottom of the pit, and sand is rammed in between them and struck off level with the tops; 2-inch planks *X* are then used to cover them, leaving room at each end of the binders for eyebolts *B* to be slipped into slots and for uprights *C* to stand inside of the bolts. These uprights rest on the binders, and run up to the parting or joint for the cope to rest on. When the cope is bolted down and rests on these uprights, the danger of crushing down is avoided, and one can feel that the mold is secure. Sand is now rammed around the uprights and eyebolts and over the planks to some 3 inches in depth. Cinder bed *D* is placed on this, extending out beyond the actual size of the pattern, and some 4 inches in depth. Pipes are connected with it extending above the floor, and hay is laid thinly over the cinders. Sand is rammed over the cinders about 9 inches in depth and well vented down to the cinder bed. The pattern is now placed and blocked up so as to leave room to tuck and ram sand, the mold, with their points toward pattern. The pattern is faced and rammed to within some 12 inches below the joint, when a good venting is given and a pocket of cinders is placed around the pattern, and the mold is rammed up to the parting.

The inside of the pattern is now cleaned out, the parts of the pattern forming the inside braces are placed and facing sand to the depth of ¾ inch is laid on pattern.

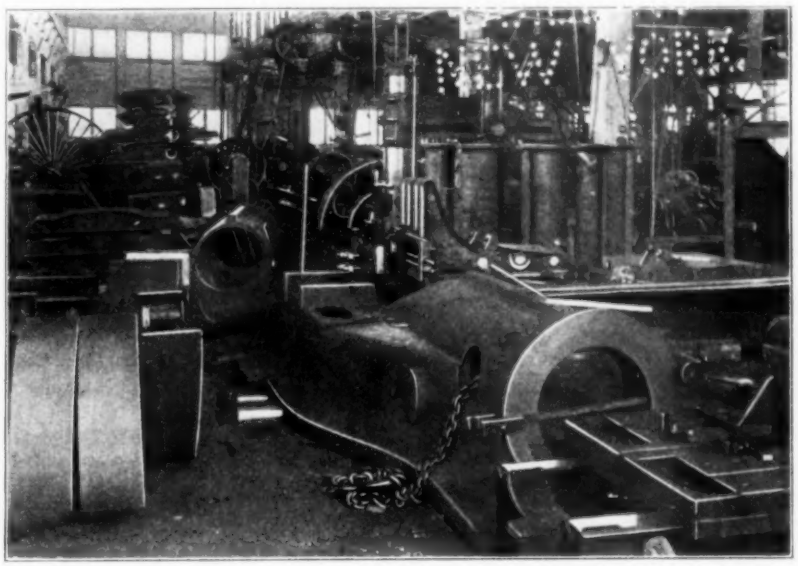


FIG. 1. A TANGYE ENGINE BED IN THE MACHINE SHOP.

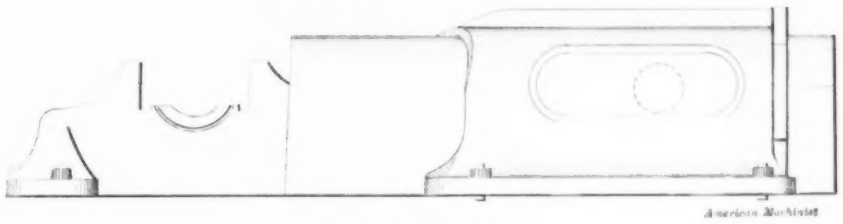


FIG. 2. SIDE OF PATTERN.

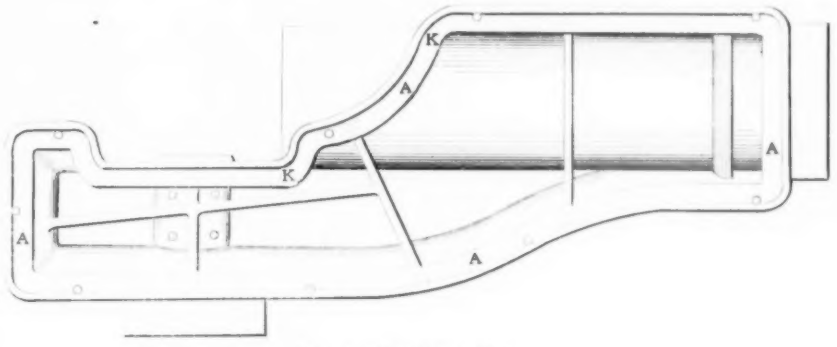


FIG. 3. TOP OF PATTERN.

and facing sand, under the pattern. It is also weighted inside. When the sand has reached the hight wished, gate cores *F* are set so that the gate *2* may connect the two jaws, that the mold may fill evenly while being poured. At the required hight the gate cores *F C* are set, also uprights or pouring gates *H H*; vents are run down close to the pattern to the cinder bed below. More sand is rammed in, and then a row of rods is placed around the sides of Anchors *Z*, made to lift the sand, are now placed inside pattern and rapped down to a bearing. Rod bolts *I* are then screwed into the anchors. These rod bolts run up through the cope, and are to hold up the anchors. Pipes *J* are pushed down over prints *K*. Gaggers are set where required, and facing sand is rammed in between the bars of the anchors, followed by heap and to the top of the anchors; the whole is then well vented. The inside is rammed

up a little above the bottom of the openings through the braces, then rods are laid through these openings to support the sand. A little sand is rammed over them, and the whole is well vented and pockets of cinders are put in. As the ramming up continues, rods are used to support the overhang, the sides flaring out as seen in Fig. 8. When within a short distance of the top the parts of the pattern forming the inside flange are plated and the overhanging sand or pockets thus formed are securely rodded. After they have been rammed up, they are well vented, the vents running toward the center. At this point pockets have been formed for cinders, and the whole is given what molders call "a good, solid venting." Cinders are now spread over the whole of this inside to a depth of between 2 and 3 inches, thus bringing the vent from the pockets formed by the flanges towards the center. Gate sticks are set into the cinders, the sand is rammed up even with the top of pattern, and the joint is made. The top braces running across the inside of the pattern are now drawn out and covering cores are placed over those parts of the mold.

The cope is now tried on, the rod bolts *I* being guided where wished between the bars; to the uninitiated, let me say, usually by being pried where wished with rammers when necessary on their coming too near or under the bars. Let me say in a job like this do the barring or chucking around a place like the pipes after you have it on for good. Guide pieces are nailed on the cope, corner stakes are driven against them, see Fig. 6 (to insure the copes return to the same place when being replaced), and the cope is rapped down and examined to see that it bears on the tops of those uprights as wished. The cope is hoisted off and wet down. It is now replaced, chucks needed around the pipes are put in, gates for blow-offs, vents, etc., set. It must be seen that the pouring gates *H* are some few inches outside the cope at each end. The cope is now rammed up, plates of iron are dropped over the rod bolts, lapping over two bars, and the nuts are run down and tightened. Plates of iron with holes are dropped also over the pipes, and nuts are screwed down on the pipes and wedged underneath on top of the bars. The cope is now hoisted up, swung to one side and finished.

Before the pattern is drawn, the sand at the ends of the core print for the main core is dug out. As the mold is some 42 inches deep, it is easier got at to finish and one can get down to guide the end of the core, besides serving the main object of ramming sand in and placing a pocket of cinders to carry off the vent from main core. A gutter or channelway is cut out around the pattern and connected with vent gates through the cope, and vents are made, with long, heavy wires very near each other all around the pattern, starting down in this channelway. While finishing the mold in the floor, nails are run into the sides near where the iron enters the mold through the gates. The heads are left very nearly even with the surface, but slightly below. The strain on a mold is often such that a very little yielding of the sides leaves the head of a nail a hair below the surface, and in that way it leaves a print on the face of casting when it comes to be cleaned up. The mold is blacked with a mixture of one-third Gilder's whiting and two-thirds silver lead facing, the whole mixed to a consistency of cream, put on with a brush, slicked and brushed over with molasses water.

The mold in the floor being ready for drying, the fire baskets are fired with coke at one side or out of doors, and when the coke is well on fire are hung in the mold, as seen in Fig. 6. Care must be taken when they are first placed in the mold that the heat is not too intense on any particular spot, as, if it is, the mold will immediately blister there, which means a scab or extra patching. After the mold has been fired for a short time, and when the heat has struck in so as to form a crust, it will stand more heat and the covering of old corrugated iron, seen in Fig. 7, is then placed over the mold to help confine the heat. It is necessary to have some openings or the fires will go out. The fire baskets are lowered nearer the face of the mold after it has nearly dried. Of course, more or less

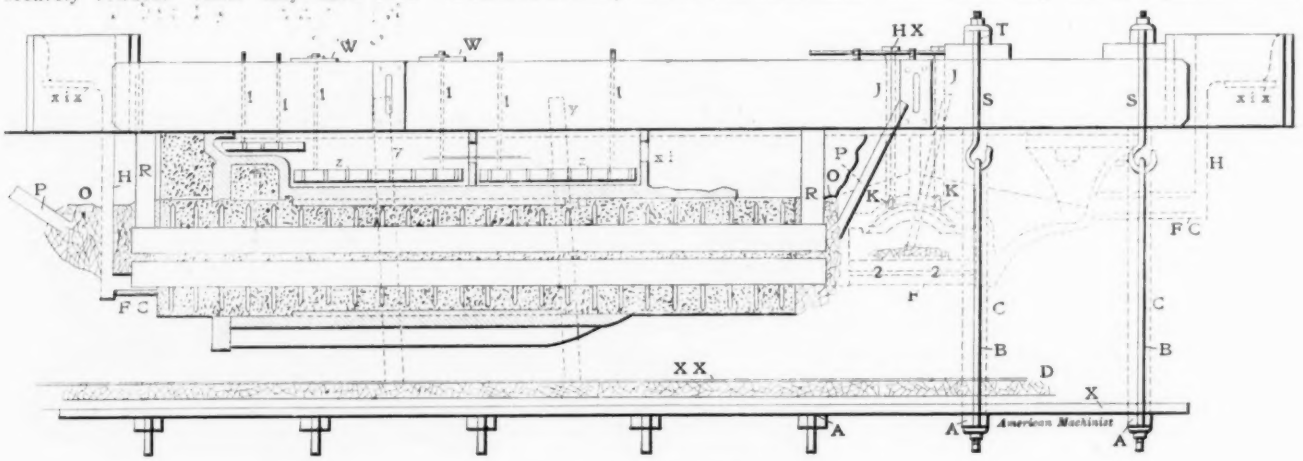


FIG. 4. THE MOLD.

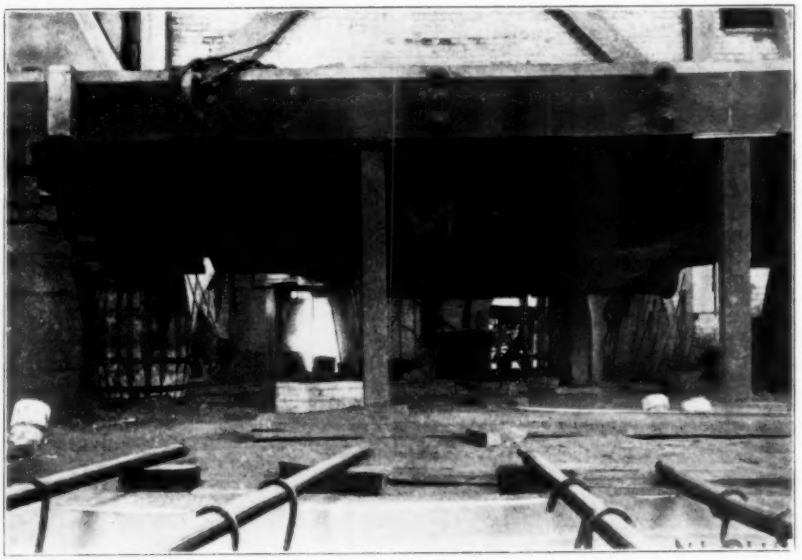


FIG. 5. MOLD WITH FINISHED COPE AT THE BACK.

ashes and cinders fall from them on the face of the mold, but these do no harm and when the mold is dried they are easily swept off the face and cleaned out.

The cope seen in Fig. 5 is dried by natural gas, but can easily be dried with a special fire basket. We find the fire baskets more convenient to use in the mold as they require very little attention. In Fig. 5, pipes to bring off the vent from the ends of the main core, and pipes *P* are led from them to above the floor to carry off vent. A spud, or piece of timber, *R* is set on the anchor of the core running up to the joint.

Gatestocks *H H* are placed and sand is rammed into the joint. Flour is used to spot the spuds, being placed on the top of each, so that the cope will bear on it and when hoisted off leave a white spot. The

FIG. 6. THE MOLD WITH FIRE BASKETS.

cinder beds can be seen just sticking out of floor, as *H H H*. The jacket core is now pasted around the four print cores on it and wires sticking from it are run up through pipes *J* in the cope, given a twist, and a rod is then run across the top of the pipe through this wire, thus holding the jacket core up against double-headed chaplets which are to give the required thickness and which are tucked in between the face of the cope and the jacket core at the right moment. The rods to form outlets for the vent are run down the pipes and into vent holes in the jacket, and sand is dropped in and rammed around this when withdrawn, leaving clear vent holes. The pipes are 2 inches diameter inside.

The main core, which is shown in the foreground in Fig. 8, is turned end for end and set. A stop-off is used over it, which forms the circle of the bed from *K* to *K*, Fig. 3. Name cores are used, but are not clearly shown in Fig. 8. A useful mixture for cores of this kind, which are said to be used on castings with a heavy body of metal, consists of 1 part silver lead, 1 part ground fire-clay and 20 parts sharp sand, wet with water. The letters will come out sharp and clear (blacked, of course). The above mixture I have always found will stand a heavy body of iron.

A stop-off core is used over the end of the core seen at *N*, Fig. 4. After this core is set, pockets of cinders *O* are formed at

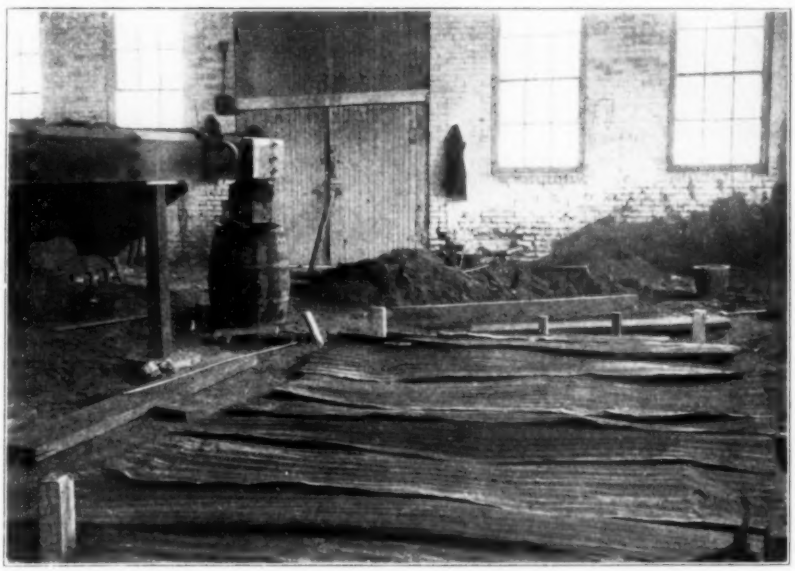


FIG. 7. MOLD COVERED WITH CORRUGATED IRON, FIRE BASKETS UNDERNEATH.

cope is tried on, hoisted off, and places are cut for the spuds to pass through and rest on those already set on the anchors.

Everything being correct, the cope is replaced and the spuds are set and sand rammed around. Binders are placed across the top of the flask. The eyebolts are dug down to, hookbolts are hooked into the eyebolts and swung into slots in the binders; washers are put on, and the nuts run down and tightened. Wedges are shoved between spuds and binders, which are arranged so that two of them will come to catch the spuds running from the anchors of the main cores; runners are built. The runner boxes come above the cope, but the bottom of the runner is below the top of the cope. This was done so that if any kick came from the small jacket core, the runner boxes could be filled and the mold flowed through; and if there was none (which I am glad to say there was not), the mold could be cut (as molders term it) when the iron was part way up in the risers, thus reducing the amount of head on the casting, and therefore the strain.

The bottoms of the runners, where the iron strikes in falling from the ladles, are formed by flat cores about 2 inches in thickness, bedded in at these points, which prevents the iron from cutting the runner as it falls from the ladle. Again, at this point the runner is hollowed a little, as it were, so that a puddle of iron is formed to cushion the fall. A short time after the pouring is finished, when the gates are set, the mass of iron forming the runner is broken into, and the mass is then easily broken up. In this way one does not have a number of heavy chunks of iron lying around or to handle and melt up.

Regarding cores: the main core anchors, running through the core, are made by bedding in the foundry floor a piece of joist heavy enough to form the center, and then pieces forming fingers on the sides at certain distances apart. Prickers are formed on the bottom by punching down a stick to the required depth. Holes are cast in the ends, so that they can be bolted together if need be, also across so that a bar can be inserted to roll over the core, if need be, for some other job.

The fact that a foundry is running on a special line of work does not alter the fact that often the unexpected is called for.

The rigging in many cases costs but little more to handle, and many times no more, when power is employed, if made a little heavier than the actual requirements; and few can look back and see foundries doing lighter work than they were built for, while many foundries are doing heavier work; so when a light-work shop starts on a heavier grade of work, the point is apt to be strained. A cope had better always be of too heavy timber than too light. If a cope springs, it many times means loss of the mold, and even if finally closed and secured very carefully, a great amount of risk and worry. The pouring gates are placed outside the end of the cope, as a shorter cope can be used, and in this way there is less weight to handle, besides being able to give just the amount of head wished in pouring, as referred to.

FIG. 8. MOLD READY FOR CASTING.

German Criticism on the Machine Tool Trade with America.

During the boom of the past three or four years in the American tool trade with Germany, little attempt was made in the latter country to depreciate the merit of the American product or to contradict the claims made for it by its promoters. Since the German manufacturers have begun to look about eagerly for orders in competition with us some of them are raising their voices in a tardy disparagement of the machines which have proved so popular among their countrymen and from which many of themselves have borrowed designs. The earnestness of this protest is shown both in its tone and in the systematic manner of its putting forth. In our No. 3 we published in abridged form an article that had appeared in the "Cologne Gazette" disallowing the claims of the Americans as against the Germans in respect to the merit of their heavy tools and supporting this contention by the alleged actual employment of such tools in German works. We have this same article published in four other German periodicals, including some of the leading technical journals, and it appears to have been in fact a circular letter prepared by the Association of German Machine Tool Manufacturers and sent around to the press generally. It very likely bears some relation to the movement that is being made to increase the German tariff on foreign built tools.

In the article referred to, an attack was made upon the German Niles Company for an utterance in its trade literature which gave more exclusive credit to American tools than the authors of the criticism thought was right under the circumstances. The German Niles Company, however, is not the only culprit, for behold! another article, apparently from a related source, has since appeared, in which some remarks made by the "American Machinist" are pilloried in the same fashion. We have before us two clippings of this second article in identical language, one from the "Chemnitzer Tageblatt und Anzeiger," the other from the "Hamburger Nachrichten." To how much further an extent it has been syndicated throughout the German Empire can only be surmised. In order that our friends on this side of the water may condole with us over the unkind things that are said about us we print a complete translation:

"MACHINE TOOL IMPORTS FROM AMERICA."

"In connection with the article printed by us a while ago, 'A Word for German Machine Tool Building,' we have received from an allied source of expert character the following communication:

"'In the issue [No. 46, 1900] of the "American Machinist" published in New York and devoted exclusively to machine tools, is found on page 1046 a leading article which, literally translated, runs as follows:

"'"ON GERMAN MACHINERY TRADE."

[We need not reprint this editorial in full, but refer our readers to the number of the paper in which it appeared. The main argument was as follows: We admitted the decline of our tool trade with Germany, and by considering the causes which had led to the previous boom, sought to determine whether another one might be looked for. Two such causes were adduced—the industrial revival in Europe, with a resulting shortage of tools, and the superiority of the machines produced by American inventive genius. Admitting that there was no reason to expect an early repetition of the first condition, we yet argued that as long as the American builders made further progress and continued to keep ahead in their improvements, so long would their tools find a market in Germany.]

"'This article contains a peculiar mixture of truth, boasting and self-delusion, with a complete misapprehension of the facts.

"'That the import of American machine tools into Germany not only has passed its maximum but within a few months really has ceased as good as altogether, there is no doubt, and the business men subsequently returning to America report correctly when they say that the American machine tool trade with Germany is already a thing of the past.

"'As regards, however, the two grounds cited in the above editorial for the enormous increase in the importation of machine tools into Germany during the last four years, only one of them answers to the facts, while the other arises simply from an incredible boastfulness.

"'It is a fact that German industrial life has soared up mightily in the last three to four years. Indeed, the boom has been so pretentious that nearly all existing industrial works have been more or less enlarged, and, furthermore, a great number of new works must have been erected. In both cases they were in greatest haste, in order to get as much of a share as possible in the prosperous situation.

"'Such an urgent demand for equipment was created and such quick deliveries were wanted that the German machine tool builders, who were prepared to meet a normal increase of demand, were not immediately in a condition to supply all the new machine tools required for these extensions and new constructions. Consequently the requirements in great part had to be covered from abroad, and because of the short deliveries that were offered this was done from America.

"'This is, however, the only ground from which Germany for a very long time was actually flooded with American machine tools.

"'The scale was turned in favor of America even then only by the very short delays in delivery which were named in the offers, but by no means through the second cause adduced in the above editorial, viz.:

"'"The American inventive genius which had produced a class of tools quite above the plane of anything the continental nations had learned to construct for themselves."

"'This assertion only shows anew the well-known American boastfulness, as likewise does this—that the exports have let up only,

"'"because the continental industrial nations have learned a little of our art and are making greater use of it."

"'The sober fact is much more to the effect that in the last three or four years German industry, with the help of the American tool manufacturers has equipped itself very speedily to meet quickly the demands growing upon it with enormous rapidity, and so to take right hold of the situation. This, as is well known, has come to pass in fullest measure, which is best shown by the export figures and the large dividends declared.

"'The import trade from America naturally ceased immediately after the extensions and new works had been equipped. By no means, however, has this taken place because Germany, in the late years, has richly provided herself with models from American inventive genius and now has learned to imitate them. That is self-delusion!

"'That these events may be repeated is not at all impossible if conditions suddenly develop, yet certainly there will not be such another inundation as that of the last three or four years, for a large part of the American sales have very much displeased the German customer. The faults were, first, the use of inadequate materials (viz., cast iron instead of the steel, or possibly cast steel, usually employed in Germany for the same parts), and further that the short times for delivery named in the offers were often exceeded in fact up to 100 per cent. and that the net weights were as much as 25 per cent. less than those stated in the offers. This is a sort of business procedure which has been openly complained of and which deserves to be dealt with severely.

"'By all means that was the wrong way to build up a permanent market in Germany and such business methods were culpable ones because the German market will permanently be lost for machines of normal character.

"'Finally, that Germany will, in the future as in the past, import from America good special machines is self-evident, for the German machinery manufacturers also are more than ever pervaded with the universal law of life,

"'"'Tis only he who strives that lives."'"

We should have little fear to have the case rest with the argument of our anonymous German critic and go to the jury of our readers as it stands; but since, in America at least, it is the established privilege of the plaintiff to close the case, we will not disdain to do so.

Our opponent asserts that the reason why all the orders that passed by German manufacturers and came to America did so was merely one of ability to make, or promise, prompt deliveries. He assumes that the matter of merit or design of the tools had nothing to do with it and that the German manufacturer was all-sufficient in the sort of tools he made. Although the primary occasion of the export of American tools to Germany may have been simply one of demand and supply, it is incomprehensible how anyone who knows anything about the subject at all can ignore the important part that the improved construction of these machines has played since the way was once opened for their introduction. It is a well-known fact that the only two nations in the world who have done much in the way of designing modern machine tools are England and America. A few years ago most of the existing German tools were the embodiment of English ideas. The extent to which the tools recently imported from America have been used as models for the new output of German tools is notorious. In the very city of Chemnitz, where the article here quoted was printed, a milling machine is being manufactured in imitation of the Brown & Sharpe to the minutest details, and even the cuts in the catalog describing it—a catalog of which a copy is in our possession—were taken from that of the American originator. There are some German builders whom we could name, and whom we have been glad to name in our columns many times in the past, who are displaying true originality in their designs, but the manufacturers of another sort who are simply making cheap copies of American tools are quite numerous. Will our friend who believes in nothing but the temporary shortage at home please account for this change of model by German tool builders?

In the charges of unfairness made against the American tool builders there is no doubt some truth. American manufacturers are not all of the highest stamp, and the many who are have to suffer for the sins of those who are not. We believe that the number of our tool manufacturers who would intentionally give a short weight is very few. As to the sort of materials used, there is no claim by our critic that these departed from the description. But ideas differ as to the advantage of various materials and what is sanctioned by American practice may appear insufficient to the machinist who has been accustomed to consider strength and solidity to the neglect of facility and convenience.

It is true enough that promised deliveries were sometimes exceeded by American sellers. We called attention to the fact ourselves at the time the shops were all tied up with work a year or more ago. The delays affected both foreign and domestic buyers and it was known at that time that the former were taking them much the harder. There seems to be much more flexibility in this matter allowed by commercial usage in America than in Germany, and while the practice of taking more orders than one can see one's way clear to fill in the stipulated time is not to be commended and is probably discountenanced by our best manufacturers, it is not regarded here as the heinous offense that our critic would have us believe it is on the other side of the water. It may be said also that our tool builders were often badly tied up by delay in getting raw materials and undoubtedly the delay in shipments often arose through no fault of theirs.

American tool designers are keeping in the lead of their German copyists in making improvements and their present product is perceptibly in advance of the generation of tools which has grown from American models in the last two years. Future attempts to overtake our builders will probably be made, not steadily, but by fits and starts, when as happened before some special circumstance stirs up the German builder and brings to his mind the distance he has fallen behind. This is to be inferred from the fact lately brought to our attention by very good authority on the German market that to a great extent there, as in Russia, buyers are satisfied with tools which are not the best nor of the very latest patterns.

In conclusion, and not to be outdone by our German critic in display of our ability to find an apt quotation, we will remind him and his mechanical compatriots that

"Imitation is the sincerest flattery."

Echoes from the Oil Country.

BRASS WORK.

I have never told you much about our foundry yet. Well, in the first place it isn't much of a foundry, and then again a man isn't very apt to think nice things about a foundry when he is trying to get through a chill on the surface of a hurry casting. It is anything but a chill that the machinist has at such times. I'm afraid the iron would never get to the chilling point in the surroundings to which the poor molder is too often to be sent by the machinist, and, very often—yes, mostly—because of things that are beyond his control.

I made a ⅜-inch tool steel set-screw once in a 26-inch lathe; had to use a tool 2x1 inch. The lathe had centers with ends—outside ends, I mean—nearly as large as the finished screw. It didn't take me quite 3½ hours to get it done, and I hated myself and the lathe for a month afterward. I was a cub then and had to do it. Now I pity a fellow that has to do work with a poor outfit when he knows better but cannot help himself.

But the reason I admire a molder so much just now is for a later experience. Sometimes we have two or three molders

and sometimes we have the boss and a boy, and sometimes we are shy the boy. Business had been quiet. Ben, the molder, was down with rheumatism, the boy was off visiting in the country somewhere, and Sammy, my usual standby in emergencies, was away on a three-days' job, when a man came in for an engine rod brass. Among all our stock of seven various castings, and all on the different engines, there was not an engine brass that would do by any feat of fitting. By the way, did you ever see a real quick first-rate job of brass fitting done—that is, nice job-shop, oil-country fitting, when you "got to get her going and get her going quick?"

I will tell you a way (I have done it myself in a pinch) that hasn't any patent on it, and it may astonish you and teach you lots if you ever try it: You see this box is ⅛ inch too big for the strap every way; too big to go into the strap; too big in the hole; too wide for the strap, and too long. Now just file the sand off up and down and drive it into the strap. Of course it springs the strap some. Take it out to the blacksmith shop and have the blacksmith put it on the smoothest plane he has on his anvil, and, putting the good flatter on it, come down a good square blow with the sledge; "again, still again; now another one, light this time; that's pretty near, needs a hair more though." If you yelled just right you will find it about 1-64 inch full yet. Now, turn it over on the side of the brass and come down good and heavy, driving the flanges close up on the edges of the strap. Better see that your strap is nearly true, or you may drive down such a good fit that you fill some hole and can't get the brasses out. Drive the brasses out and cut in two; take out enough to close them up to nearly the right length. It will help the hole and make less to file front and back. Now square up the front and the back, finish the fitting up and down, drive into the strap, catch it in the chuck and set the strap true from the face of the chuck. Bore the hole and face one side, turn it around and face the other side. File off the sharp corners, file a notch for the oil to get at it. If your customer puts on style out at his place, hold the edges of the flanges on the emery wheel for a minute or two. Tell him to use plenty of oil for a couple of days and watch her a little, and send him away happy to be ready to run again after supper. Time 1 hour and 8 minutes, including time of making change and giving advice. Charge $8.50, and cheap at that, for that was good brass and well fitted.

To get back to where I was. It was important for him to have a set of brasses at once, as he must keep running, and I must make them. I set a green hand at building a fire in the brass furnace while I looked for a pattern. The nearest one I could find was away too big one way and too small another, but that was nothing. I had often had Ben fix them a great deal worse than that. I only had to cut out a little here and fill in a little there; that was simple enough. I helped get the fire going and the pot in and charged with some nice, heavy red scrap, and then I started to mold that brass.

Did you ever try to cook when your wife was away? I guess that sand must have been too wet, to have it all stick so. I'll try some a little dryer. That must have been too dry, or it wouldn't drop to pieces as soon as I began cutting; but I guess I can fix it with the swab. Now, that is a pretty good mold, but I will make another one for fear of accidents; and then, it pays to keep a few good brasses, that you can make most anything out of, on hand.

It was getting dark when we were ready to pour. I never knew it was so hot over a brass furnace before, nor so chokey like; but the brass seemed to go in all right, when I poured it. If I had known enough to shake it out and throw it into water, it might have helped take off some of the sand. But I didn't, and after supper I took it out and fitted it up myself—not any lightning way either. I am glad to say that only one was good; and I would put that one up against all creation for being the worst good brass I ever saw. It was hard. I had to slow the engine down to plane it, and our planer runs slow naturally. The sand was burned in, away in. There were some nice little holes in it to catch and hold the oil. I knew what I intended to make out of it; it would have taken a smart stranger to tell from looking at it. I let my friend, who was waiting for it, start for home between midnight and morning, while I went to bed in full sympathy with molders in general and ours in particular, feeling I had advanced far enough in the craft to be an honorary member at least.

Of course, I still bless the fellow that puts a 2-inch core in a 3-inch print and puts it all to one side, that forgets to cut a gate in the hurry job with the man waiting, that has loose dirt everywhere in his casting, that turns his cope halfway round and makes a monstrosity, or that does any of the many other things that loudly proclaim his carelessness and indifference, or, as one old boss puts it, "his don't-care-a-damnativeness"; but for the many things that can happen when a man has done his best with the means at hand, I feel like making much allowance.

To make good castings of all kinds with sand whose only claim is that it is accessible, iron that is of all unknown kinds and conditions, fuel likewise, flasks not exactly suited for anything—"just keep it; it isn't good for anything, but may come in handy some time"—help from the machine shop when you want a lift—fellows that can't understand that a mold should be handled like a baby and not like castings—these things bother a job shop molder, although he is not to blame for them.

W. Osborne.

Electric Distribution of Power in Workshops.

At a recent meeting of the electrical section of the Franklin Institute in Philadelphia, the advantages of the electric drive for shop tools were enumerated by Prof. F. B. Crocker as follows:

(1) Saving in Power.—This is generally the first point to be considered, but is by no means the most important, as cost of power in most factories and mills is only 1 to 3 per cent. of the total expenses, the cost of labor being usually many times greater. It is, however, a fact that electric driving usually secures a considerable saving in the consumption of power.

(2) Cost of Buildings.—Since heavy overhead shafting is not required for electric driving, the buildings may be made much lighter and cheaper in construction than for ordinary mechanical driving.

(3) Cost of Equipment.—The relative expense of equipping a factory with electric motors or with belting and shafting depends upon circumstances, but would usually be greater for the former. The difference, however, is not very great, and the saving in buildings noted above would generally make up the balance. The depreciation on the electrical plant can easily be made less than that on belting and shafting; lubrication is also less and the attention required is no greater.

(4) Arrangement of Machinery.—The use of electric motors enables the machinery to be placed in almost any desired position. It is not necessary that they should be parallel or arranged in rows or placed at any particular angle with respect to each other. With belting and shafting, on the other hand, the machinery must be arranged in a very particular manner, and very often it has to be placed where the light is poor, and accessibility or other important matters have to be sacrificed.

(5) Clear Head Room.—The elimination of overhead belting and shafting by the use of motors gives a clear head room, which enables overhead cranes to be used freely, and also avoids the great obstruction to light and air, which is a serious objection to the old-fashioned methods.

(6) Cleanliness.—The dripping of oil from overhead shafting is a constant source of trouble, and the dirt thrown out from belting is an even worse enemy to cleanliness. The agitation of dust by belting and shafting keeps it in constant circulation, so that it penetrates everywhere and everything.

(7) Health of Employees.—On account of advantages in regard to light and air and the reduction in dust and dirt, it is found by actual experience that the health of those who work with electrical driving machinery is improved. In the Government Printing Office in Washington, one of the largest in the world, it was found that the sick list was decreased 20 to 40

per cent. after electric motors were introduced.

(8) Convenience for Detached Buildings.—The electrical method enables detached buildings to be reached easily and economically, which is not possible with ordinary methods. The buildings, like the machinery within them, can be located for general convenience, and not with special regard to supplying them with power.

(9) Freedom for Growth.—For similar reasons it is a simple matter to extend a building or add another in any direction or at any time as desired, whereas with the old method of driving, the shafting must be installed originally with the idea of extension, or else it must be replaced later. In fact, the length to which shafting can be run is very limited, and the extending of a building, or the erection of another, may require the installation of an additional steam-power plant, which is decidedly objectionable. The electrical plan enables all the power generation to be effected at one point and wherever it is most convenient, even though some distance away.

(10) Shut-downs Less Frequent and Less Serious.—An accident in an electrically driven plant usually has a local effect only, simply shutting down one or a few machines, while with belting and shafting the breaking or slipping off of a belt may require the whole or a large portion of the machinery to be stopped, in order to make the repair. In a large establishment a delay of even ten minutes represents a very considerable item in wages, and the interruption of the work is demoralizing. It might be argued that the central plant might break down, but that is just as true of a mechanical installation as of an electrical one.

(11) Speed Control.—The variation of speed that is possible with electric driving, and the convenience as well as range of control, are very great advantages with most kinds of machinery. The operator can drive the tool to its limit of capacity, and can on the other hand instantly relieve it of strain, if he finds it necessary. With mechanical driving the means of speed control are far more limited and less convenient than with electric motors. The shifting of the belt on a cone pulley, for example, and the throwing in and out of different sets of gearing is a clumsy operation which a workman is not likely to attempt in order to gain slightly in the efficiency or rapidity of working.

(12) Increase of Output.—Owing to the many advantages named above, but especially on account of clear head room for overhead crane service, and convenience of speed control, it is found that the output of manufacturing establishments is materially increased in most cases by the use of electric driving. It is often found that this gain actually amounts to 20 or 30 per cent., or even more, with the same floor space, machinery and number of workmen. This is the most important advantage of all, because it secures an increase in income without any increase in investment, labor or expense, except perhaps for material. In many cases the output is raised and at the same time the labor item is reduced.

Mr. Samuel M. Vauclain, superintendent of the Baldwin Locomotive Works, said that he was now prepared to place on record his cordial endorsement of the modern method, on the score of its many and great advantages over the old style of power transmission by lines of shafting, which it is displacing.

The speaker favored belt connections for tools in which there was considerable jar, on account of the elasticity of the method. He pointed out also that machine tools as at present built were not adapted for motors, and in so adapting them he would not alter the structure of the tool so that motor and tool would be one unit, but would provide room so that any motor from the market could be applied as an extra device. He dwelt at some length upon the important economies in the saving of floor space and in operating expenses which had been realized in the Baldwin works by the introduction of the electric driving system, in testimony of which he made the statement that "if we should abandon electric driving, our manufactured product would now cost us from 20 per cent. to 25 per cent. more for labor;" and again, "were it not for electric driving, the Baldwin Locomotive Works would have to cover 40 per cent. more floor space than they now do, to maintain their present output."

Mr. Vauclain said, in conclusion, that while the question of the saving in power which the adoption of electric motors permitted was of importance, it was by no means the deciding factor, and that he would put in electric driving systems not only if they saved no power, but even if they required several times the power of a shaft and belting system to operate them.

Mr. Gano S. Dunn said that one of the greatest engineering advances that have been made in recent years is in course of accomplishing in the introduction of electrical power into our factories, and by such introduction so greatly will be altered the cost of many kinds of product that we shall experience a readjustment along economic lines that will have important bearings farther than we can see. Already electric power distribution is one of the factors which are enabling American industries to undersell and to give better deliveries than the industries of other countries, and the reasons for this tremendous advantage it indeed behooves us to investigate and to discuss within the widest limits.

Pattern Making—Thin Rings.

BY JOHN M. RICHARDSON.

There are many different ways, as here shown, of making thin ring patterns. The lap joint *A* is seldom used and has no particular strength. The shoulder joint *B* is stronger, but, like the first, is seldom used. The tongued joint C is one of the commonest and best, when using but one layer of segments. The tongues must have the grain run at right angles to the sawed slots to insure strength. The lock-corner joint *D* is extremely strong, and will be described further on.

The ring *E*, made of two layers, is a very poor method, and will not retain its shape against the tendencies of warping and moisture. The three-layer method, shown at *F*, is a standard and I know of none better or more practical.

Upon examining the different ways shown, it will be noticed that *C*, *E* and *F* require segments of one-sixth of a circle each, while *A*, *B* and *D* require their segments to be each as much over one-sixth of a circle as the length they project into the adjacent piece.

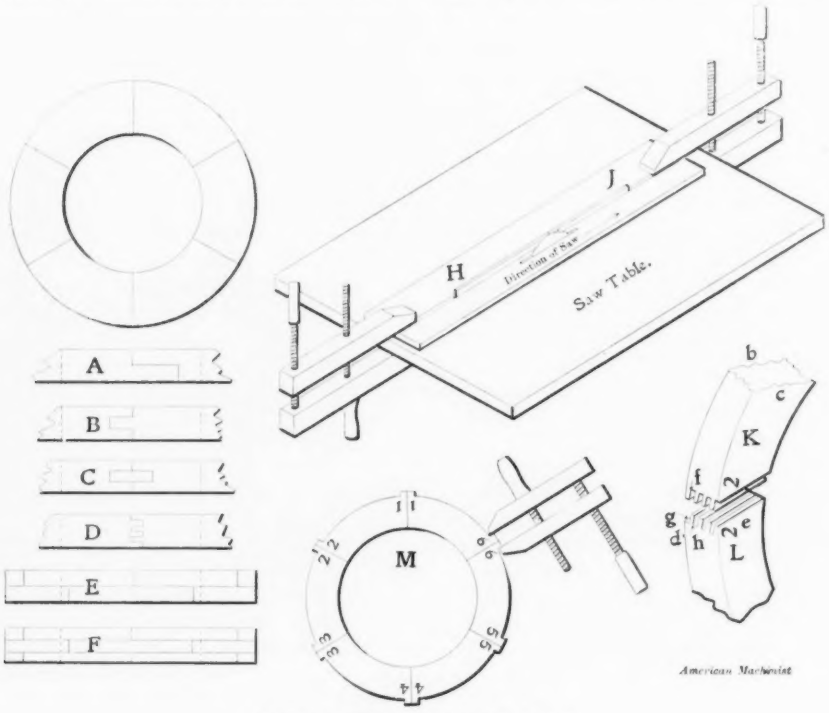
As the form of joint *D* is somewhat of a mystery to some, and yet can be readily made on any circular saw, I will describe the mode of making it: Take a board six or eight inches wide and nearly as long as the saw table, and make a saw cut along the middle of it ¼ inch deep. Now move along the guide rest a distance equal to the width of the saw kerf, and turn the board the other side up, keeping the same edge against the rest as before and let it carefully down over the saw so that the latter will come through it a little way. Adjust the rest very slightly both to the right and to the left, lowering the board over the saw as before. This is in order that there may be a little play sideways for adjustment when setting for use.

The board I have just mentioned is *H*. A little hardwood strip must now be glued into the long saw cut first made, and it should not project upward more than the depth of shoulder on the shortest joints made; 3-16 inch will be about right for common use, for the depth of shoulder on most joints of this kind will be from ¼ to ⅜ inch. We are now ready to clamp the board to the saw table, as shown, and we test its position after the saw has been raised to the right hight as follows: Pick up any little waste block and hold it on the board and against the lip of hardwood at *J* and pass it through the saw. Next put this cut over the lip *J* and slide it through the saw again. Do this as many times as the width of block requires. Repeat the operation on a similar block and try them together. If they fit easily, so that they will slide together without any friction, then all is right. If not, the board on saw table must be shifted to one side or the other *very slightly*, always keeping it perfectly parallel with the saw and a second test must be made on two more blocks.

When the final adjustment is completed we will consider a piece of actual work on the segments, as shown at *K* and *L*. The six segments must be carefully fitted

to come together nicely to make the circle, bearing in mind what was previously said about having each of them as much longer as the depth of tongue, so that they will be of the right diameter after being sawed and fitted. One side of each piece must be faced smooth. It makes no difference if the other side is rough and uneven, or if the pieces vary somewhat in thickness, for the smoothed surface is the "work edge," as we say, for the whole operation. For convenience in placing, the top, or uneven side, should be marked as shown in *M*.

To return to our job, take the piece *K* and hold it so that the lower edge of the surface *b* opposite to *c* comes against the lip *f* of the board on the saw-bench, and make a cut and continue as in the trial block, until all the cuts are made. Now reverse the position of the piece *K*, placing the first cut *f* over the lip of *L*. This brings the back surface *b* of the piece *K* exactly in line with the right-hand edge of the saw teeth. We must now hold the piece *L* against *K* so that the surface *d* opposite to *e* comes against *b* of block *K*, and press together, sliding the two blocks as one piece along the lip and over the saw. This cuts the place *g* in *L*, and *K* can now be laid aside. Rest *g* against the lip and slide across the saw, cutting away *h*. This cut is next fitted over the lip and all the other cuts made in succession.



MAKING PATTERNS FOR THIN RINGS.

The two pieces *K* and *L* will now lie perfectly flat after being locked into one another, no matter how uneven the surfaces *c* and *e* may be. The operation is very much easier than the description. *M* shows the segments sawed with a heel left at each end for clamping. This need not not project over ¼ inch, but is a great aid in drawing the pieces together. Have the joints fit loosely, otherwise the moisture of the glue will swell the numerous surfaces and the joints will stick, and the glue set before they can be drawn into place, and if this happens there is no help for them.

The Grisson High Reduction Gearing.

A good deal of interest is being manifested in Germany over the Grisson gearing for use in connection with electric motors, for which use a high ratio of speed reduction is very desirable. This gear is a revival in modified form of the two-toothed pinion, having the two teeth in different planes, the modification consisting of the use of roller teeth in the larger gear. The two-toothed pinion, with sliding contact and radial faces in the larger gear, is shown and discussed in McCord's "Kinematics," where the gear is said to be very satisfactory in operation except for the large amount of sliding which it entails. The use of roller teeth in the Grisson gear is, of course, to do away with this excessive sliding.

Fig. 1 shows the construction of the gear and Fig. 2 is a side elevation showing its appearance in an actual case. The pinion speed in the construction shown in Fig. 2 was 1,200 revolutions per minute and the speed ratio was 12. Fig. 3 is from a photograph and shows a construction in which three teeth were used in the pinion, the work being obviously of considerable magnitude. The teeth of the pinion will be seen to be of the form of heart-shaped cams, each tooth working on its own set of roller teeth in the gear, these roller teeth being placed between appropriate flanges.

The leading feature of the gear is, of course, its high ratio of speeds, together with great compactness and a small center distance. The smallest permissible ratio is said to be one to five and the action of the gears is better with higher ratios. The efficiency also increases with the ratio, experiments being said to have shown an efficiency as high as 95 per cent.

The American representatives of Grisson & Co. are C. Lembcke & Co., of 88 Wall street, New York.

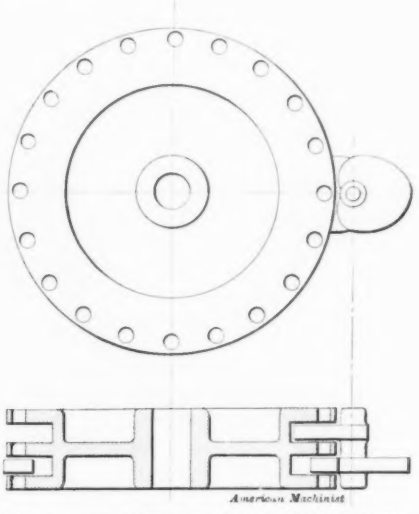


FIG. 1. ARRANGEMENT OF GRISSON GEARING.

Letters from Practical Men

Teachers for Manual Training Schools.

Editor American Machinist:

In your issue No. 2 Mr. Stanwood discusses the manual training school teachers' qualifications. It seems to me that one of the great mistakes of our manual-training schools lies in the fact that the instructors are instructors in a pedagogic sense and no more.

Let us first consider what we are trying to make of the boys in these schools. We are trying to fit them for work in the shop. Practical every-day methods should be used so that when they go forth to join the great industrial army they will be able to not only maintain the positions in which they are placed, but to advance along the lines of their chosen vocations. But how many of them do? Remember it is to the graduates of these schools we would naturally look for men to some day raise our standard of skilled artisans.

In this sense they are a disappointment so far as the writer has noticed. When these young men come into the shop they are always ready to say to the foundryman, the patternmaker, the blacksmith or the machinist: "I worked at that when I was at the so-and-so manual-training school," but ask them one plain practical

question about either of the trades referred to and they seem lost. Ask them to take hold and do a job (it may be a simple job as jobs go in the shop) and they will tell you "we were not taught that at our school," and yet they may have spent one or two years at a manual-training school. This shows, to my mind, that something is wrong in the method of teaching.

To overcome this I would suggest that instructors in these schools should be taken from the ranks of foremen who have a record as skilled artisans and also for making good mechanics out of their apprentices.

When we stop and think we see that in such foremen we have real manual instructors and by having such men as instructors we would make the schools a practical institution. These foremen are continually showing the apprentices the right and the wrong way of doing the work in hand and giving the reasons why it is done so and so. They do this because of the pride they take in making good mechanics out of the raw material, and the same incentive would make them successful in the manual-training school.

It was the writer's experience to attend for two winters an evening school in a New England city in which mechanical drawing was taught (?) The instructor was a kind old gentleman who taught us scholars to make nicely-colored drawings, taking lots of time with colored paints to bring out the parts and lots of time lettering these drawings, one hour being sometimes required to *draw* the word "Elementary." Now there was very little that was practical in all this and the writer soon found it out when he came to handle drawings in the shop, and it is such methods that make our manual-training schools failures.

If we are going to turn out skilled artisans from these schools we should above all things have skilled artisans as instructors—foremen artisans who have shown their qualifications as instructors by the way they have handled apprentices.

M. A. J.

Kingston, N. Y.

Editor American Machinist:

In the majority of instances, the men who are engaged as instructors in shop work or manual training in our technical schools are selected from the mechanics who work in the shops. The chief qualifications required are that they shall be able to execute a good piece of wood-work, smith-work or machine-work. In other words, they should be good mechanics or artisans. Apart, however, from these requirements, they are in a great many instances engaged regardless of any previous educational training, beyond that which they may have picked up in the workshop, and are rarely asked the important question: "What do you know about teaching or pedagogy?" They are often engaged simply and solely on their replies to the significant questions: "Are you a good mechanic?" and "What is the smallest salary you are prepared to accept for your services?"

It appears to the writer that the man who is engaged to act as a teacher of shop-work or manual training should be required to possess equally as liberal an education as the teacher who teaches English, mathematics or chemistry, because his responsibilities in teaching and forming the character of young boys and girls, and fitting them for honorable positions in social life, are equally as great as those of the teacher of the sciences and kindred subjects. In some schools the pupils devote more time to manual training, per week, than to some of the other studies, thereby coming into contact with the instructor in this work, and being under his direction and supervision for a period of time, which will, without question, have great influence on their development and training.

By way of illustration, the writer has some pupils in his classes in manual training who devote a large portion of their time, not taken up by other studies, to doing extra work in his room, thereby being under his control and training for, in some cases, ten hours per week. It is almost needless to say that this amount of time spent in the presence of a teacher must necessarily greatly influence the minds and moral qualities of his pupils, who will assimilate, more or less, his personality and character, be it good, bad or indifferent.

In addition to possessing a good education the teacher of manual training should be a good talker and demonstrator. He should also have a good command of the English language and be able to use it correctly, and under no circumstances

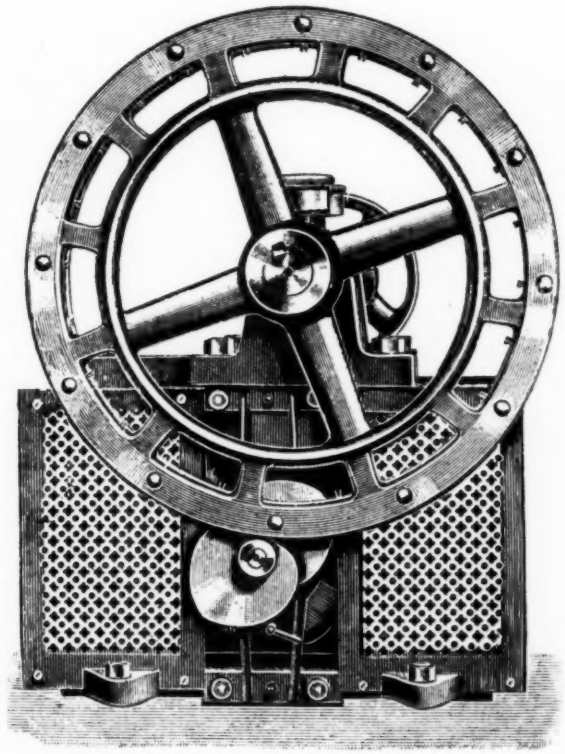


FIG. 2. AN EXAMPLE FROM PRACTICE.

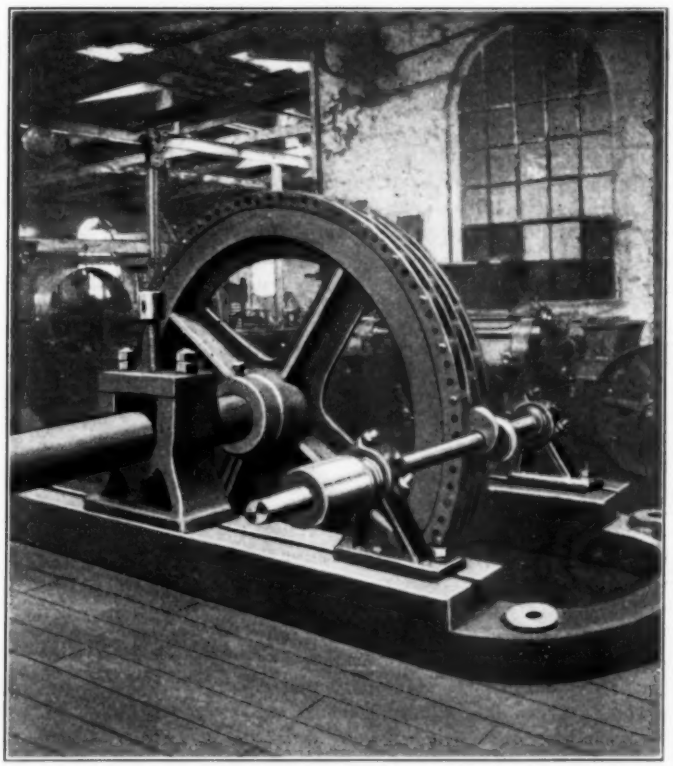


FIG. 3. GRISSON GEARING USING A THREE-TOOTHED PINION.

should he use any slang phrases during the demonstrative lesson in respect to a piece of work or in personal conversation with any of his pupils. In addition to all the above good qualities and accomplishments he must also be a good mechanic, which as a matter of course is absolutely indispensable.

There are many teachers of manual training who do not possess all of these essential qualifications, because the teacher who is taken from the shop, although he may be a good mechanic, is generally very defective in the necessary technical education, while the man who is college-bred considers it beneath his dignity to enter a shop and learn a trade in order to become a mechanic in addition to his acquired education. Therefore the combination of mechanical ability supplemented by a technical education is a rare one, and is seldom met with.

Of course, there are men among the mechanics who have acquired a fair elementary education, but who unfortunately know nothing about the art of teaching or pedagogy; the latter being very essential to the successful teacher who is willing to study and improve himself. If such men are fortunate enough to receive appointments as teachers they will avail themselves of every opportunity to improve their education and will make very fair teachers in the course of a few years.

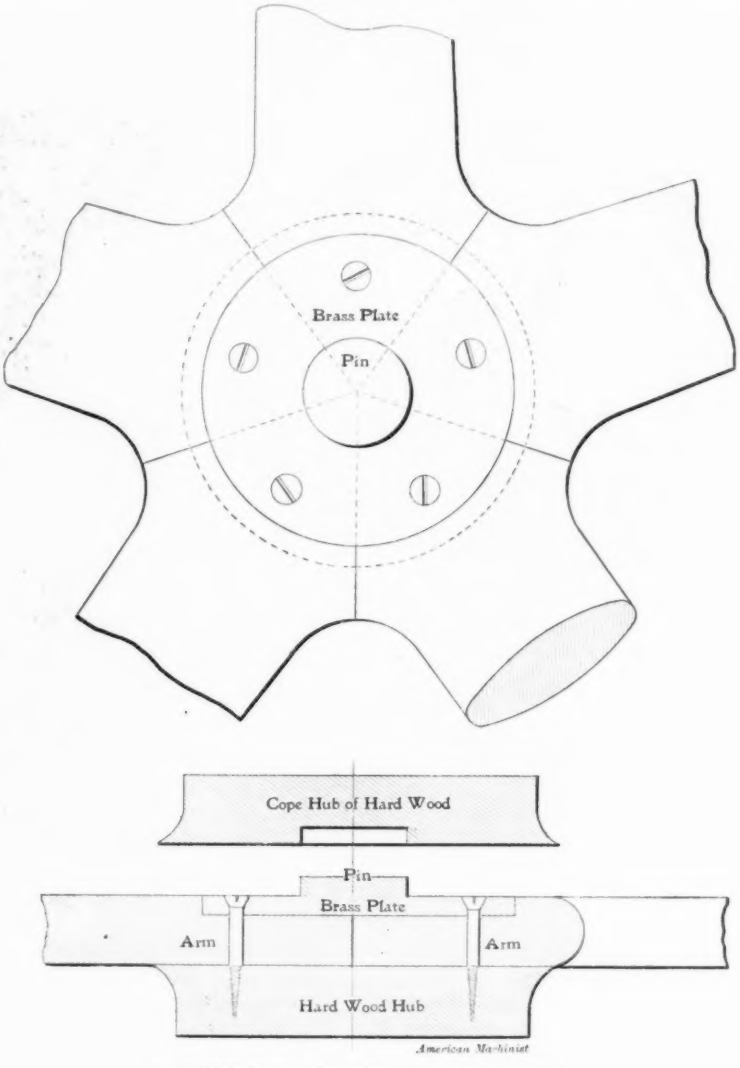
A TEACHER.

Fastening the Arms of a Wheel Pattern.

Editor American Machinist:

The enclosed sketches illustrate a way of fastening together the arms and hub of a small fly-wheel pattern. We have tried a number of ways, but so far have found this the most satisfactory. The arms are made to run to the center and the hardwood hub is glued to them. A recess is turned in the cope side to take the brass plate, which is screwed in place with one screw through each arm into the hardwood hub as shown. The cope hub, which is loose, is turned with a recess to fit over the pin part of the brass plate. There is nothing very new about this, but it may be a suggestion to some of your readers.

"HOBO."



FASTENING THE ARMS IN A WHEEL PATTERN.

Cost Accounts and Prices.

Editor American Machinist:

We have read with great interest the article in your issue No. 4 on "Dividing the Burden in Cost-Accounting at the Works of William Sellers & Co.," and we would express our thanks to the author for emphasizing the fact that the "leading value of a correct system of cost-accounting in any business which manufactures a line of staple goods for sale from the warehouse, is not that of determining prices," and for stating plainly that "prices at any moment are determined by the state of the market." "Increased cost from any cause, except, for instance, a general increase in the cost of material or labor, which affects all manufacturers, is not reflected in the prices obtained; nor does high cost in any establishment enable that establishment to obtain better prices than its competitors." The development of cost formulas has undoubtedly been of great advantage; but, like other good things, they have no value when misapplied, and we think they have been very frequently misapplied in stating prices, with the result that less than the market prices have often been maintained; and when experience has shown the "perfect" formulas to be inaccurate, serious losses have sometimes resulted.,

The writer had one friend, the manager of a large business, who never allowed what we might call the "assembled figures" of his cost sheets to be known outside of his own office; and he used them as a yard-stick to determine whether or not the prices submitted to him were too high or too low. The prices at which the goods should be sold were fixed largely by examination of competitors' price lists and discounts, and by judging the probable trend of the market. Our own experience is that judgment as to the market should prevail on all stock goods, and that cost accounts are chiefly valuable in some classes of jobbing and in some large and special contracts.

BUILDERS IRON FOUNDRY,
Z. CHAFEE, Pres.

Spacing for Prime Numbers of Gear Teeth.

Editor American Machinist:

Those of your readers who look below the surface of things will recognize Mr. Ben Noble's plan for indexing for prime numbers of gear teeth, given in your issue No. 3, as being essentially the same as my own plan, published in your issue No. 49 of last year. In fact, Mr. Noble's device was made after he had consulted me as to the practicability of applying the principle of my device to a universal milling machine. To his inquiry I replied that the principle could be applied wherever it was possible to make the driven shaft react on the driving shaft without locking the latter. He then expressed his intention of

connecting the spindle of the dividing head to the index plate, to which I replied: "Yes, that is all right, *provided you get in the proper gear ratio.*"

Mr. Noble overlooked this advice, and as a result his construction will not work as intended. I do not care to go into many details nor to demonstrate anything, but simply state that if you want to cut 59 teeth with the sector set for 60, gears *B* and *B B* must not be even, as he seems to think, and as his sketch shows, but must be in the ratio of 60 to 40; and if, in general, we wish to cut *n*—1 teeth with the sector set for *n* teeth, gears *B* and *B B* must be in the ratio of *n* : 40. From this it follows that gears *B* and *B B* should not mesh directly together, but should be joined by a quadrant with one or two idlers or some similar device.

If the proper number of idlers (for instance, one) and the proper gear ratio are used so as to cut 59 teeth, then the use of two idlers will cut 61 teeth. Anyone who tries to use Mr. Noble's device will obtain the following results: With the sector set for 60 teeth and even gears *B* and *B B* meshing together, the blank will have 58½ spaces; if the gears *B* and *B B* are smaller with an idler between them, 61½ spaces will be made. Anyone who understands the milling machine and a little mathematics can work it out for himself, though I should be glad to help over the rough places if help is needed.

I sincerely regret that the "American Machinist" has been "taken in," though I understand how almost impossible it is for the editor of a well-filled paper, dealing with a wide range of subjects, to go to the bottom of every article and detect all fallacies.

A. L. De Leeuw.

Hamilton, Ohio.

[We must confess to undue laxity in reading the description of Mr. Noble's device, the apparent simplicity of which rather captivated us.—Ed.]

A Special Casting from a Regular Pattern.

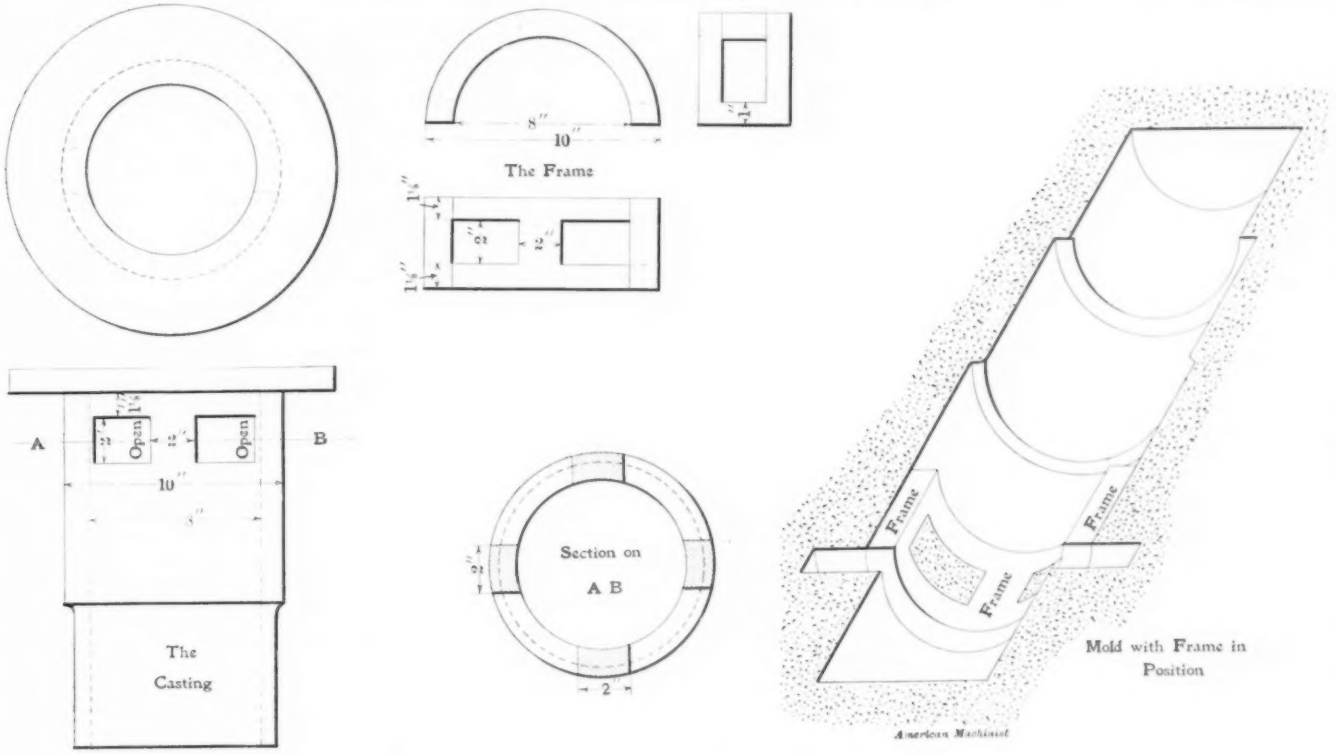
Editor American Machinist:

The sketch shows at the left a casting that was ordered from us a few days ago. It was part of one of our regular machines for which we had a pattern (made in halves) and a core box. The only difference between the casting ordered and as regularly made was in the four openings under the flange. These four openings were made in the casting without any alterations to our standard pattern or core box.

The frame in the sketch was a half-section of that part of the casting under the flange where the openings cut through. The outside of this frame was sawed to the diameter of the pattern, 10 inches, and the inside to the diameter of the dry sand core, 8 inches, that formed the round hole through the body of the casting. The thickness of the semi-circular ends of the frame was the distance from the inside of flange to the edge of openings, 1⅛ inches. This was the guide for setting frame in mold.

At the right is shown one-half of the mold with the frame in place, the openings in the frame being rammed full of green sand and strickled off, forming cores that cut the openings through the casting where required. The frame was drawn and the same operation gone through with on the other half of the mold. The central core (of dry sand) when set, just touched the green sand cores formed by the frame, and everything was lovely. This is how we made this special casting without altering our regular pattern.

"Hobo."



MAKING A SPECIAL CASTING FROM A REGULAR PATTERN.

The De Laval Steam Turbine Shaft.

Editor American Machinist:

In a paper read before the Engineers' Society of Western Pennsylvania and published in your issues No. 4 and 5, Mr. Francis Hodgkinson, speaking of the bearings and rigid shaft of the Parsons steam turbine as compared with the slender flexible shaft of the De Laval turbine, does this in a way that may possibly convey the idea to the minds of your readers that the De Laval flexible shaft is liable to crystallization and eventual rupture. Judging from the thorough knowledge Mr. Hodgkinson seems to have of the De Laval turbine, this cannot have been intentional. The object of the De Laval flexible shaft is to allow the turbine wheel to revolve around its true center of gravity, thereby decreasing the pressure and friction in the bearings and also eliminating all vibration. This in fact it does, as there is not a single record of the shafts having ever been broken on account of crystallization.

At the Paris Exhibition, a De Laval turbine was exhibited which had been in daily operation for seven years, during that time completing about 20,000,000,000

revolutions without any of its original parts having been replaced, and the writer knows of one instance where a flexible shaft and turbine wheel, having run about the same length of time as the above machine, were cut into testing pieces and tested, and the material was found to be practically unchanged. E. MEDEN.

Philadelphia, Pa.

Two Fixtures for Machining Curved Castings—Placing Castings in the Jig—Proper Locating Points.

Editor American Machinist:

The castings shown in Fig. 1, a pair of "trigger arms," right and left hand, require finishing on the inside bosses at *A*, *B*, *C* and *A'*, *B'*, *C'*, as well as drilling two 5-16 inch and two ⅜-inch holes in each. The castings are about 11 inches long.

The first operation is with the profiling fixture shown at Fig. 2. A pair of castings to be machined are placed with ends *A* and *A'* in the V-block, resting on permanent pieces cast solid on the fixture base. Thumb-pins *a* and *b* are set at a slight angle, forming adjustable stops, which are held in place to withstand the pressure of the cutter by knurled thumb-screws. A set piece for depth of cut is provided by the tool steel pin at *C*. The stud and strap in the center hold the work.

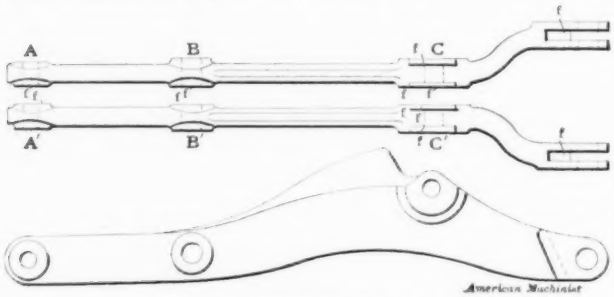


FIG. 1. CASTING TO BE MACHINED.

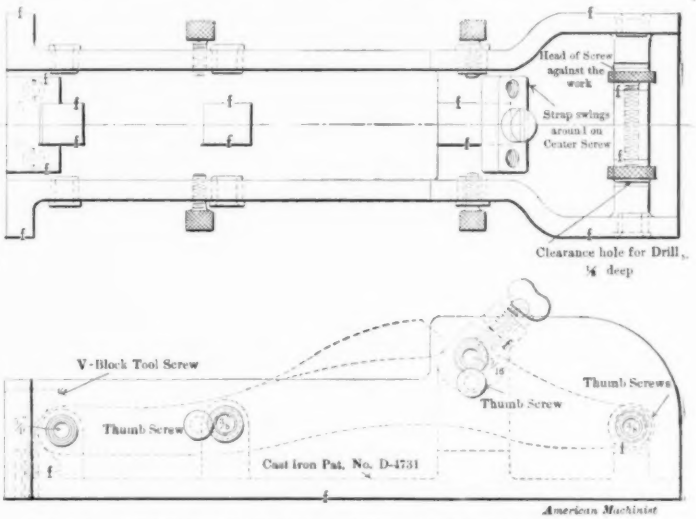


FIG. 3. DOUBLE DRILL JIG FOR TRIGGER ARMS, RIGHT AND LEFT.

The drill jig at Fig. 3 also is arranged to take in two castings, right and left hand, the side elevation of this fixture shows by heavy dotted lines the position of the castings ready to be drilled. Knurled thumb-screws at the sides set the castings tight against the finished projecting blocks in the center of the jig. The single revolving clamp with two screws holds the castings down and into the V-block.

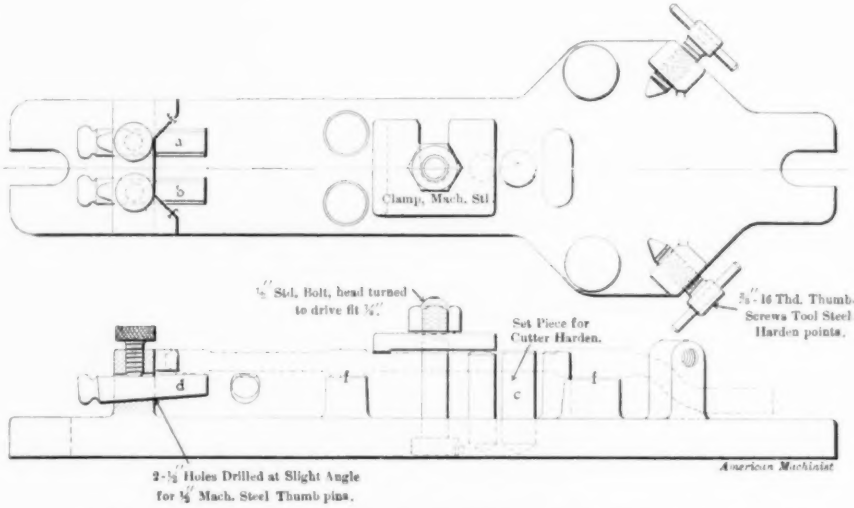

a
b
Clamp, Mach. Stl
⅜" Std. Bolt, head turned to drive fit ⅜"
⅝"-16 Thd. Thumb-Screws Tool Steel Harden points.
Set Piece for Cutter Harden.
d
c
2-½" Holes Drilled at Slight Angle for ⅜" Mach. Steel Thumb pins.
American Machinist

FIG. 2. DOUBLE PROFILING FIXTURE FOR TRIGGER ARMS, RIGHT AND LEFT.

It is often the case that certain castings are drilled in a jig with holes accurately spaced, but the base or working point overlooked to such an extent as to cause trouble in the assembling department. It is well for the tool designer to keep in view all the connecting points of the various movements of the apparatus for which he is making tools, working from the connection of one piece to another, rather than locating from some convenient projecting lug on the casting, which may possibly make the jig much easier of manipulation but cause such inconvenience to the assembler as to lose all the time, and more, which the jig man saves by rapid drilling.

D. E. MACCARTHY.

What the Lathe Hands Think of the Compound Rest.

Editor American Machinist:

The article of H. W. P. in No. 2 induces me to say something on this subject. In the shop where I am employed there are ten lathes, all having compound rests. Some of these have in addition plain rests, the use of which is optional with the lathe hands, but the change is never made. After being shown Professor Sweet's method of threading, they become at once adherents of the compound rest. Your correspondent speaks of its use in this connection simply for roughing threads. We finish the threads and cut the time in two over the old method in the following way: Grind the tool to gage and then give it top rake sufficient, 5 degrees being about the least. Set the compound rest to 23 degrees instead of 30, but set the tool by gage as usual. This forces the back side of the tool to scrape just enough for a good finish. This does not give a theoretically correct thread; as for instance, in a one-inch, eight-pitch thread, with 5-degree rake the angle of the back cut is incorrect about ⅛ degree, or, in other words, the space between the top of the thread is too narrow by .0004⅓. By grinding or stoning off the point of the tool on that side, it is easily corrected. We use a stop on the compound rest which enables us to duplicate threads with very little calipering or trying.

I would suggest that manufacturers make the inner end of the compound rest to match the circle of the base, instead of carrying it out square at the end, as the corner collides with the dog or other projections when running up close to the head with the rest set at any angle other than 30 or 0 degree. H.

Why Wouldn't the Engine Work?

Editor American Machinist:

I have read with a great deal of interest and considerable hilarity the article

by W. Osborne entitled, "Why the Engine Wouldn't Do its Work." (I claim originality on the arrangement of capital letters anyway.) To a non-scientific cuss who has been driven to run sawmills many years, it looks rather strange that two men firing one boiler with dry kindling wood would not have "got up steam" enough to blow that overloaded safety-valve wide open, even if the steam gage showed 397 pounds pressure. Especially as boiler and engine, including governor, were both in first-class condition.

Excuse my airy persiflage, but if one man could "fire" this boiler with green slabs when the steam gage was all right, why could not two men get up steam enough to saw one log at least, even if they had no steam gage at all? Having run mills in Missouri, Mr. Osborne will have to "show me" before I can give him credit for even an ingenious story.

GEO. F. WILLIS.

The Cross Section of Screw Conveyors.

Editor American Machinist:

The construction for finding the cross-section of a screw conveyor flight given in the "American Machinist" No. 5 by Mr. J. A. Brown is very ingenious, and perhaps more economical of time than the construction that has been in use in laying out the rolls for the making of such conveyors under the writer's patent.

It is suggested at the close of the article that it would be an improvement if the conveyor flight could be produced so that the finished section would be of approximately uniform thickness. Naturally, this idea has had considerable thought on my part. There is some value, however, in the tapering cross-section of flight in that it presents the thin edge to the material that is being conveyed, and therefore offers less frictional surface where the edge comes in contact with the material. In practice it is found that a conveyor flight with thin edge will wear quite as long, as far as the edge is concerned, as if the flight were much thicker, and the ability of a conveyor flight to resist lateral pressure is the point of construction requiring the greatest attention. The triangular or tapering cross-section of the flight is an admirable shape to resist this lateral pressure; but even if it were conceded that a conveyor flight of uniform cross-section would be a desirable product, the nature of the trade in this particular specialty is such that, as Mr. Brown hints, the attainment of the result would not be "commercially profitable." Aside from the expense of experiment, which I should say from my experience would be very great, it would be necessary to secure from the ordinary sources of supply strips with precisely that tapering cross-section which, when passed through the rolls, would produce exactly the spiral desired. The entire tonnage of conveyor spiral used is so small that it would hardly be of interest to the rolling mill, and since beginning the manufacture of my helicoid conveyor we have found it necessary, in order to meet the demands of the trade, to produce about fifty different varieties of the spiral. This feature of the matter is one that would probably prevent a profitable manufacture of the style of flight suggested. It may be said in passing that the process for making the form of flight suggested by Mr. Brown is the subject of a patent to Mr. O. N. Caldwell, issued in August, 1887.

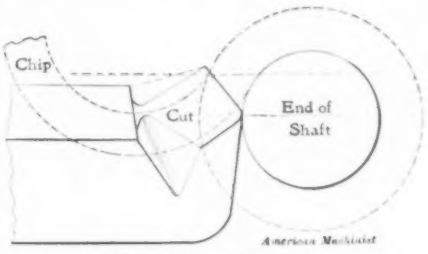
Our ability to use the ordinary product of any strip rolling mill is one feature that enables us to manufacture the helicoid conveyor in a "commercially profitable" as well as "mechanically practicable" way.

Chicago, Ill. F. C. CALDWELL.

Tool for Heavy Cuts in Steel.

Editor American Machinist:

Replying to your correspondent, who asks, in No. 1, for the best tool for heavy



A TOOL FOR HEAVY CUTS.

cuts in steel, I think the one shown in the sketch is best and will do the work with the least power of any I know of.

FAIRFIELD GRANT.

Gas Engine Gaskets.

Editor American Machinist:

Gaskets leaking water into the cylinders or combustion chambers of gas engines are a source of considerable trouble, sometimes making the explosions very weak and at others even *nil*. In gas-engine parlance, it "fogs the mixture," and, with electrical ignition, sometimes causes a short circuit, and at others a breaking down of the insulation, we having known several sparkers rendered *hors de combat* by the water breaking the porcelain or lava insulators.

There are several causes why gaskets begin to leak or are made to leak. One very common cause is that the engineer, or more often the mere attendant, starting the engine in the morning lets it get too hot before turning the water into the jacket, and sometimes throws the load on without sufficient water to keep it cool. I have seen several very interesting wrecks caused by neglecting the water until after a run of an hour or so, one instance of this kind occurring recently in our neighborhood. It was a 50 horse-power vertical, double-cylinder engine, running at 310 revolutions per minute, which had become very near red hot, when the attendant (in this case) turned the cold water into the jackets, causing the cylinders to contract and grab the nearly red-hot trunks, when something had to go; so the wrists were pulled out of the trunks, and it cost very nearly a new engine to repair it.

Draining the cylinder at night is a very commendable practice, as it leaves a dry cylinder to start with; but the penalty for forgetting to turn the water on in time is sometimes quite heavy. Should you forget, and then find the cylinder very hot, do not at once turn the water into the jacket, but shut off the gas and let her cool and then turn in the water very slowly. Own up; be frank with the boss. After all, it is better to lose a few minutes than to wreck the engine or start the gasket to leaking.

But, to get back to the causes of leaky gaskets; a great many can well be laid at the door of the manufacturer for his not putting in a sufficient number of studs or bolts, or for their not being of ample size to make an adequate joint at the head or explosion chamber. He may say that they are ample, and numerous enough to withstand the pressure of the explosion, which we must say is true in nearly all cases; but we claim that their mission is twofold, they having not only to withstand the pressure, but also to make watertight a joint that is subjected to very great variations of temperature. Now, the making and pulling up of a gasket on a gas engine, if it is done right, is no little job, especially if it is a large one. I think I give about the right estimate when I say that three-fourths of all the gaskets on gas engines in this country are made of asbestos board or paper, the other fourth using ground joints, white lead, etc.; and one-half of them are not put on with the care they should have before leaving the factory.

The method that we have found to give us the best results is as follows: Take asbestos board, 1-16 inch thick, and make a gasket the full size and shape of the head, and then take a sheet of 1-32 inch thick (this can be done by wetting 1-16 inch board and separating the sheet) and make a gasket that will conform to the inner circle or shape of head or chamber. By putting the two together they form a gasket 3-32 inch thick on the inner circle or shape and 1-16 inch thick on the outer edge. Dampen the gaskets sufficiently to make them quite pliable; put on and tighten them up. Turn the water into the jacket and start the engine, and it is likely the water will be seen oozing out all around. Now is the time to jump on the wrench just as hard as the studs will stand. Keep right at them until the engine is fully up to normal temperature, and if the studs are numerous enough and of ample size, the gasket will prove a good one for some time to come.

FRED C. TYGARD.

On the Need of Education of the Judgment in Dealing with Technical Matters.

(*Continued from page 165.*)

destruction with the careless remark, written officially from the other side of the country, that the requirements of the specifications must be fulfilled.

You must not understand me to mean that physical tests are not very important in deciding the quality of material, but when applied without judgment they may result in great waste of both labor and material, for they do not present the whole case, even as to the character of the material of which the test pieces themselves are made. We often have plates of steel where the test pieces, cut directly from the plate, will give fine results—say 60,000 pounds tensile strength and elongation of 30 per cent. in 8 inches, and will double over on themselves without sign of fracture, and yet the plate itself would break like glass in bending over a large radius. I have cut test pieces right out of plates that would not bend at all, and the test pieces would double over on themselves without sign of fracture. Not long ago I had a plate of government material to bend on the press for a keel plate, but the plate broke hopelessly in bending. There was no other plate to replace it of material that had been tested and accepted for government use, and the inspector would not allow any other plate to be taken for the purpose. I, however, took a plate of steel for merchant work and bent it to the required form with no sign of fracture. We cut a test piece out of the broken plate, right by the fracture, and it showed 61,000 pounds tensile strength and 28 per cent. elongation, and bent over on itself without fracture. Then we took a test piece out of the plate that had been successfully bent to the desired form and showed 62,000 pounds tensile strength and 22 per cent. elongation, and it broke before it had completely bent over on itself. Therefore the perfectly bent plate was not allowed to be used because the test piece did not meet requirements. Here the test intended to guard against the use of unsuited material resulted in preventing the use of eminently suitable material; not because of anything wrong in the test, but through the lack of judgment in applying the result of the test to the desired end.

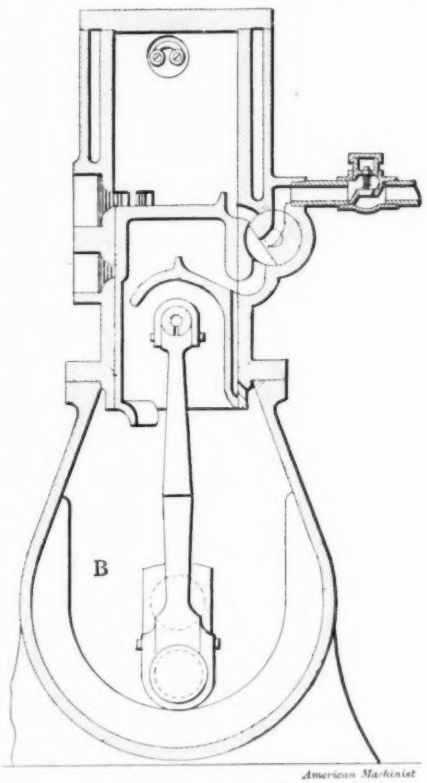
I could multiply cases—they are of almost everyday occurrence—where the lack of judgment in regard to the value of tests results in needless loss and in great delay in carrying out work. Lack of judgment is often manifested in a demand for unreasonably strict compliance with a specification that makes no allowance for ordinary imperfections in all products, even of the most skillful workman. Not many days ago I had such a case to deal with in building a small marine boiler for the Treasury Department under a very strict specification. I found that it would make better work to weld the plate forming the sides of the combustion chamber, as the seam was in the way of the stays as shown in the drawing. The inspector thought so, too, so the plate was welded; but the slight waste in heating resulted in the plate being 1-32 inch thin at the weld. I did not foresee this, but the inspector discovered that the plate was slightly thinner at the weld, and, the specification requiring a certain thickness of plate, the work was suspended until a decision should come from Washington. The decision came in due course and in the usual form, instructing the inspector to require the work according to the specifications. Now, if this had been made as specified, with a riveted joint, its strength would have been, say, 67 per cent. of the plate, while the welded joint gave 92 per cent. Yet, notwithstanding all this, the work was condemned and thrown away. This loss did not result from any desire on the part of the inspector or his superior to cause loss to the contractor, but simply from a failure on their part to apply sound judgment to the question before them.

A plan or specification is an instrument to be used for the production of a certain piece of engineering work. The thing produced is the only reason for the instrument being brought into existence, and when once the instrument has served its purpose its value disappears. Yet engineers engaged to apply this instrument are, as a rule (especially the young men), more intent on applying the instrument than in considering what the instrument may be doing, forgetting that the instrument can of itself produce nothing, and that if not applied with judgment it will produce only such things as the man that made the instrument could himself produce. But when applied with the correcting power of sound judgment, acquired in the production of similar things with other instruments, it becomes pliable in the hand of a master, and the result is the combined power of the instrument with the trained judgment of him that applies it. All technical men engaged in producing tangible things out of ideas expressed in our defective language, interpreted by someone perhaps better acquainted with words than with things, and whose judgment has not been matured by any intimate knowledge of the actual work that the specification he is to enforce is intended to produce, feel how hard it is to get their position understood, and how often they must do things against their better judgment for fear it may be thought that their own interest, and not their experience, is the foundation on which their judgment rests.

Some New Things.

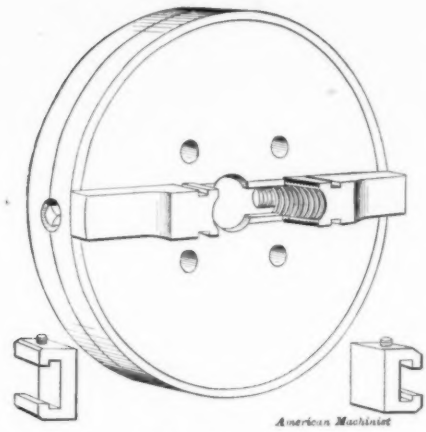
A REAR-COMPRESSION EXPLOSION ENGINE.

The cut shows a novel arrangement of functional parts for a two-cycle engine, as recently patented by Charles R. Daellenbach, Park Gate, Pa. The essential parts are the closed air chamber below, the cylinder with the end projecting down into the chamber, the trunk piston, the rocking valve and the oil supply pipe, the latter having a check valve. The upper opening on the left side of the cylinder is the exhaust, and the lower opening is for air admission. In the position shown in the cut, the exhaust passage leading from the explosion chamber is entirely uncovered and the bulk of the used-up charge has escaped. As the piston rises a partial vacuum is created in the crank chamber and at the same time a charge of gas or gasoline is drawn into the gas chamber in the upper part of the piston, where it is heated and expanded. At the completion of this stroke the air inlet is uncovered and air rushes into the crank



A REAR-COMPRESSION EXPLOSION ENGINE.

chamber, and on the return stroke this air is compressed and backed against the gas, preventing its further inflow. When near the end of this stroke the passage in the side of the piston is in communication with that in the side of the cylinder, and the position of the rocking valve has changed so that there is a continuous connection from the gas chamber in the piston to the explosion chamber of the cylinder, and the gas under some pressure reaches into the explosion chamber followed by the air, where they are commingled and from which they expel the remaining products of the previous explosion. On the subsequent upward stroke the charge is compressed and is ready for ignition. The rocking valve is operated and the charge is ignited by any of the familiar devices.



NEW CHUCK JAW.

A new form of chuck jaw is shown by the engraving, which practically explains itself. It is used on a two-jawed chuck and is turned true on the face and hardened in the usual way. At the sides and above the gripping surface, grooves are cut which serve to hold what are called false jaws, which slip on to the regular jaws and which may be of any desired form and may be cut with an impression to receive work of any form or unusual shape. These chucks are being placed on the market by the Oneida National Chuck Company, Oneida, N. Y.

A NEW ALLOY.

Charles T. Hennig, of Brooklyn, has recently patented (United States) a metallic alloy, or rather the process of making it, which it is proper for us to mention. The patent, by the way, has been assigned to a resident of London, England. The alloy is said to be malleable at a dark-red heat, to possess great tensile strength and to be not readily acted upon by alkalies or acids. The following is from the specification:

"To make a useful alloy which is forgeable at a dark-red heat and which has great tensile strength I use, say, 55 pounds of copper, 45 pounds of zinc, 3 pounds of iron and ⅔ pound of manganese; second, to make a useful alloy for casting, say, 55 pounds of copper, 45 pounds of zinc, 6 pounds of iron and 2¾ pounds of manganese; third, for very hard castings, say, 55 pounds of copper, 45 pounds of zinc, 12 pounds of iron and 5½ pounds of manganese. When these metals are together in a molten state, I effect their combination into a useful alloy by introducing into the mixture a suitable carbonate, such as carbonate of potash, carbonate of soda, carbonate of ammonia or bicarbonate of soda. The manganese specified may be added in the form of an oxid or in the form of cupro-manganese or of ferromanganese. In making my alloy the ingredient metals are preferably melted together in a crucible or other suitable receptacle. For example, the iron and the manganese may be added first with a portion of the zinc and copper—say one-fourth—and melted and the balance of the zinc and copper added gradually and melted. When the ingredients are all melted and together, I effect their combination into a useful alloy by plunging and stirring into the molten mass a suitable carbonate, such as carbonate of potash—say from one-fourth of a pound to a pound per one hundred pounds of the alloy. I have found it advantageous shortly before the alloy is poured to stir the molten mass rather quickly once or twice with a stick of wood. Other carbonates of alkali metals—such as carbonate of soda or carbonate of ammonia, or bicarbonate of soda—may be employed in lieu of the carbonate of potash above specified. The carbonate employed is preferably introduced into the molten mass wrapped in a paper or other suitable package.

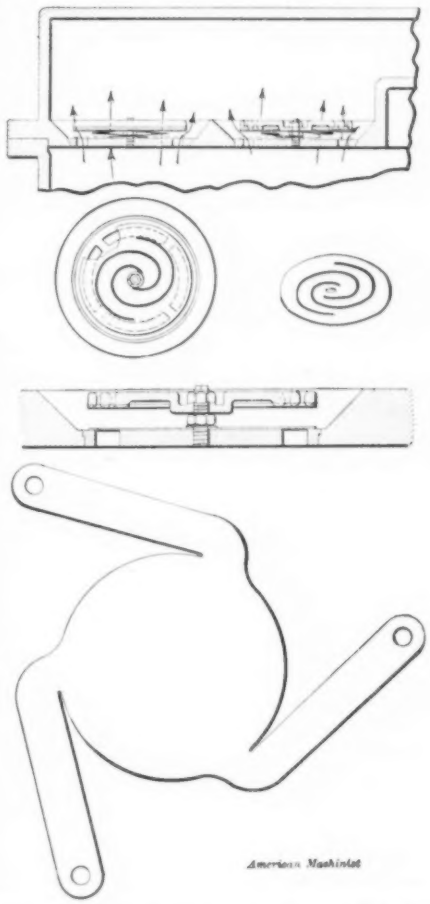
"Cobalt may be used in lieu of manganese, if desired."

A SERIES-PARALLEL SYSTEM OF CONTROL FOR ELECTRIC MOTORS.

The ingenuity of the designer of an electric motor for varying and difficult service is severely tested when he is set to meet the requirements of a large cylinder printing press. The duties there required include driving the press at a high and variable rate of speed led up to smoothly, and capable of being stopped suddenly, yet without jar. It is also requisite that the motor be able to give small fractional turns to the cylinder, as required at certain stages of the process of "making ready," these movements demanding great "torque" to set in motion the heavy masses of machinery and needing also to be made slowly and smoothly. The electrical appliances devised for these purposes have usually depended upon a single commutator motor with a large rheostat, which must necessarily waste a good deal of current in cutting down the voltage, or else upon an auxiliary motor, dynamo or motor-dynamo.

A radical departure has recently been made by the C & C Electric Company, 143 Liberty street, New York, in designing a series-parallel system of control for this class of work. They use but one motor, which has a double-wound armature with two commutators. For starting the press, where slow motion but high torque is required, the windings are connected in series, and when running at high speeds, in parallel. These connections are made by two automatic solenoid switches, and the entire control of the motor is effected by the simple movement of a lever back and forth, the switches operating at the proper point of the movement of the lever. The variations in speed are aided by a resistance bank as well as by the series and parallel connections named. There are other special features to the apparatus besides those stated.

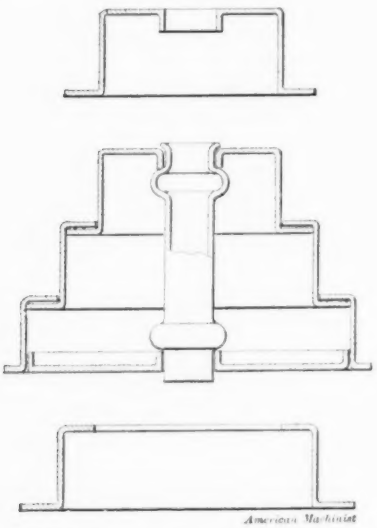
While the primary object in designing this motor system was driving printing presses, which forms a good criterion of its flexibility, it can be adapted to different classes of machinery, such as blowers, rolls and certain other machine tools. Some 125 and 150 horse-power equipments for plate glass grinders and polishers were recently in process of construction. The manufacturers do not, however, recommend the use of the system on tools requiring less than 15 horse-power, nor for intermittent work, but for long runs with heavy machinery at varying load and speed.



VALVES FOR BLOWING ENGINES AND AIR COMPRESSORS.

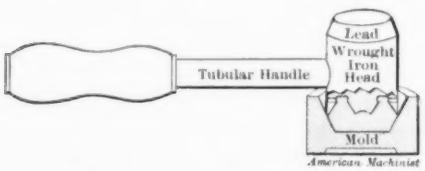
Mr. Julian Kennedy, of Pittsburgh, who has done much in the development and improvement of blowing engines and air compressors, has recently devised and patented some interesting valves for this service, thus contributing to the mitigation of the most serious troubles encountered. The desirable features of such valves are that they shall be as light and have as little inertia as possible, and that they, with their appurtenances of springs and buffers, shall occupy also as little clearance space as possible. In the valves here shown these conditions seem to be as nearly complied with as possible. The idea embodied is simply that of making the valve and spring of a single piece of sheet metal. The seats of such valves are usually inserted into the cylinder head, so that they as well as the valves may be renewed when necessary. In the cut, at the

top, is shown a section of a vertical blowing engine cylinder head with two valves in position. The valves are shown as raised against the buffers by the inrushing air. A plan of the valve and seat is given and an inclined view of one of the valves. The interior portion, cut spirally, forms the spring, and the valve proper consists of the outer ring. Below these is a larger section showing one of the valves in position and closed, while at the bottom is a suggestion for a valve of entirely different shape, also covered by the patent.



A SHEET-METAL CONE PULLEY.

Friedrich Albert, of Nuremberg, Germany, has recently patented in the United States a cone pulley made entirely of pressed sheet metal, as here shown. It is expected to be held together by the tight pressure of the edge of the flange of each smaller step against the interior of the larger one. The plate forming the large end of the pulley may be riveted, welded or brazed at the periphery. The sleeve is expanded or riveted over the smaller end of the pulley. Nothing is suggested in the specifications as to crowning the belt surfaces.



MAKING SOFT FACED HAMMERS.

We have shown recently two different modes of casting hammers of soft metal for machinists' use, and we show in the accompanying cut a still different scheme for practically the same purpose. In this case the handle and the middle of the hammer head are constantly retained, the faces only being renewed as required. A more firm, shapely, satisfactory handle is thus secured, and the hammer is practically indestructible. When the face needs renewing the hammer is heated sufficiently to melt out the head or other soft metal used. The head is then placed in the iron mold, as shown, and the metal is poured into the gutter which surrounds the hammer, entering the mold through small holes around the hammer head, filling it and rising up into the dovetail grooves, which, with the metal in the side holes, hold it securely. The ring of metal outside is knocked off and the job is complete. These hammers and molds are made by the Jackson Manufacturing Company, Reading, Pa. They also make copper-faced hammers complete, and also various other odd articles for machinists' use which have usually been made in the shops as required. Among these are hammers of soft Norway iron, copper or lead-faced vise-jaw caps, driving rods or rammers, file cleavers and special tool holders for lathe or planer.

Apprentice Don'ts.

The following "don'ts" are impressed upon the minds of the apprentices in the tool department of the National Cash Register Company:

Don't be careless about your personal appearance.

Don't waste time nor materials supplied by the company, such as oils, waste, etc.

Don't be careless in the use of the company's machines, tools and other property.

Don't leave your machines or benches in unclean and untidy condition.

Don't use dull or poor tools.

Don't fail to get to work on time, and to give the company good, honest service.

Don't whistle loudly, indulge in catcalls, or otherwise annoy your fellow workmen.

Don't rush to the lavatories nor down the stairways.

Don't depend on others to assist you in holding your position.

Don't borrow tools from your fellow-workmen.

Don't transact private business on the company's time.

Don't become indifferent because you think your time for promotion has passed.

Don't think you are doing too much work for the wages paid. By doing more work you might succeed in having your wages increased.

Don't abuse any of the privileges extended to you by the company.

Miscellaneous Wants.

Advertisements will be inserted under this head at 25 cents a line, each insertion. Copy should be sent to reach us not later than Saturday morning for the ensuing week's issue. Answers addressed to our care will be forwarded.

Gear Wheels, gear cutting. Grant; see p. 22.

Caliper cat. free. E. G. Smith, Columbia, Pa.

Forming lathes. Mer.Mach.T.Co.,Meriden,Ct.

Punches & dies. Wal.M.Wks.,Waltham,Mass.

Gasoline motor castings; best jump-spark plug made. Orswell, 34 Beach, Boston.

Light and fine mach'y to order; models and elec. work specialty. E. O. Chase, Newark, N. J.

Book "Dies and Diemaking," $1, post paid. J.L.Lucas,Bridgeport,Ct. Send for index sheet.

Wanted—Designing and drafting, by competent mechanical draftsman. Box 255, A. M.

Would like to correspond with patentees of improvements in grinding machinery. Box 1435, Providence, R. I.

"Brandt's Triple Expansion Gaskets" are the best for boilers. Randolph Brandt, 38 Cortlandt st., New York.

Designer wishes to correspond with firms desiring to manufacture gas engines. Box 283, AMERICAN MACHINIST.

Castings, with working drawings, for gas or gasoline engines; marine and stationary type; prices moderate. Address Box 140, Ft. Wayne, Ind.

Automobile Engines (5 H. P., gasoline or steam)—Full set shop drawings mailed on receipt of $1. McHarg Engine Co., 280 Lark st., Albany, N. Y.

Threads and gears; easy rules to cut any thread possible to be cut in the lathe, without algebra, sent to any address for 25c. by G. W. Dixon, Spring Lake, Mich.

Tempering.—Full instructions for hardening and tempering tools, instruments, saw-blades and springs, sent to your address for 25c. J. & D. Whittington, 67 Winslow ave., Buffalo, N. Y.

$3,500 will purchase small machinery plant within 25 miles of New York city, capable of working 10 to 15 mechanics; all machinery and tools up to date and suitable for medium heavy work; terms reasonable. Address "Lee," care AMERICAN MACHINIST.

Institutions retiring from business having machine tools, brass and wood working machinery will find it to their interest to correspond with us. We purchase complete plants or handle them on com. C. C. Wormer Mach. Co., 55-59 Woodbridge st., W., Detroit, Mich.

An Eastern concern manufacturing transmission machinery wishes to establish permanent branches in Chicago and St. Louis. Persons having had experience in this line will kindly address "Machinery," care AMERICAN MACHINIST, giving all particulars both as to experience and salary expected.

Belting, Motor and Engine Manufacturers. Note—Manufacturers of transmission machinery wish to enter into correspondence with parties manufacturing similar lines who are to exhibit at the coming Pan-American Exhibition, with a view of having circulars distributed from their exhibit; will pay liberally for the privilege. Address Box 261, AMERICAN MACHINIST.

Wants.

Situation and Help Advertisements only inserted under this head. Rate 25 cents a line for each insertion. About six words make a line. No advertisements under two lines accepted, and no advertisements abbreviated. The cash and copy should be sent to reach us not later than Saturday morning for the ensuing week's issue. Answers addressed to our care will be forwarded. Applicants may specify names to which their replies are not to be forwarded; but replies will not be returned. If not forwarded they will be destroyed without notice. Original letters of recommendation or other papers of value should not be inclosed to unknown correspondents.

Situations Wanted.

Draftsman, technical graduate, desires change. Box 270, AMERICAN MACHINIST.

Many years' experience as toolmaker, designer, inventor, foreman; would change; specialties preferred. Box 248, AMER. MACH.

Wanted—By foundry foreman, foremanship of foundry making engine castings or general jobbing, heavy or light. Address Box 178, AMERICAN MACHINIST.

Situation wanted as master mechanic in manufacturing company; a thorough mechanic and up to date; large experience. Box 281, AMERICAN MACHINIST.

Wanted—A position, by a chemist, graduate of Mass. Inst. of Technology; has had experience in factory methods; best of references. Box 276, AMERICAN MACHINIST.

Young man with 7 years' practical and technical experience on machinery, wishes position as draftsman or otherwise; will start at beginning. Box 275, AMER. MACHINIST.

Wanted—Position by strictly temperate and energetic traveling or office salesman, special machinery; excellent testimonials from leading machinery company. Address Box 272, AMERICAN MACHINIST.

Mechanical engineer, sober, reliable and competent, having had long experience in charge of men, machinery and power plants, desires a change of position. Address Box 227, AMERICAN MACHINIST.

Mechanical engineer, 20 years' experience, can handle men and make correct estimates of labor and material, good designer, thoroughly posted on tools and methods and reliable every way, wants position. Address "Chicago," care AMERICAN MACHINIST.

Wanted—Position as superintendent; capable of organizing and handling a machinery plant in all its branches; am a designer of special and automatic machinery, tools, jigs, fixtures for the rapid and economical production of interchangeable work. W. H. S., AMERICAN MACHINIST.

Mechanical engineer, with 18 years' experience as foreman, master mechanic and superintendent, is open for an engagement; small and medium machine construction preferred; have a large practical experience in estimating and in keeping accurate cost and time accounts. Box 268, AMERICAN MACHINIST.

Having completed a temporary contract, I am open to engagement as manager or superintendent of a manufacturing establishment in New York or vicinity; thoroughly practical; 20 years' experience; up in modern methods; conference with interested parties can be arranged at any time. A. F. B., care AMERICAN MACHINIST.

A mechanical engineer of great experience, who has been out of active business for a while, but has kept in touch with the times, and made several valuable improvements on the Corliss engine, would connect with a responsible engine company having an office in New York, or that intends to establish one; he has many calls for engines from old customers and others; his name and reputation would benefit any company; would also supervise plans and estimates for moderate salary; a long list of customers can be used for references. Box 277, AMERICAN MACHINIST.

Help Wanted.

Machinists.—Wanted—Two or three first-class, all-around machinists. Gifford Bros., Hudson, N. Y.

Wanted—A thoroughly competent pump salesman; an excellent salary will be paid to the right party. Box 236, AMER. MACHINIST.

Air Compressor Salesman.—Experienced, reliable and active salesman, to travel Eastern and Central States; references. Box 279, AMERICAN MACHINIST.

Wanted—Experienced draftsmen on high-speed marine engine work; state age, references, where last employed and salary required. Box 282, AMERICAN MACHINIST.

Several first-class machinists, accustomed to heavy work, can find steady employment in comfortable, well lighted shops. Address Box 278, AMERICAN MACHINIST.

Wanted—Two first-class erecting engineers; must be men of good address and familiar with high-speed engine work. Address, stating age and experience, Watertown Engine Co., Watertown, N. Y.

Wanted—An experienced rivet machine operator, on open and solid die, both single and double-stroke machine; state experience; good position for the right party. Address Atlas Bolt & Screw Co., Cleveland, O.

A small manufacturing company desires a technical graduate with some business experience to assist in the sales department; only those who are hustlers and willing to work need apply. Address "Permanent," care A. M.

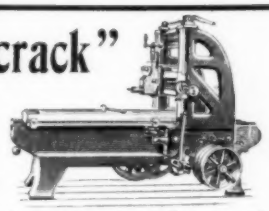
We are enlarging our works, and will shortly require an increased number of skilled mechanics; we invite application from pattern makers, molders and machinists. Address the Westinghouse Machine Company, East Pittsburgh, Pa.

Wanted—By Clark Bros., Belmont, Allegany Co., N. Y., machinists; Buffalo wages and steady employment; Belmont is a pretty village of 1,500 inhabitants, in the natural gas belt, with first-class schools, low rents and every inducement to men with families.

Wanted—By a manufacturing company near New York, a man of energy, strong executive capacity, technical training and practical experience in machine work; the company produces a wide variety of machines, and wants permanent additional force in the engineering department; salary $50 per week, for which corresponding ability will be required. Address W. S. G., care AMERICAN MACHINIST.

Wanted—By an established concern manufacturing high-grade machine tools, a first-class draftsman who is thoroughly familiar with the designing of turret head chucking machines for both screw and general work; must have held a position with some leading concern manufacturing machinery of this class; a splendid opportunity for the right man. Write, giving full particulars, to Box 280, AMERICAN MACHINIST.

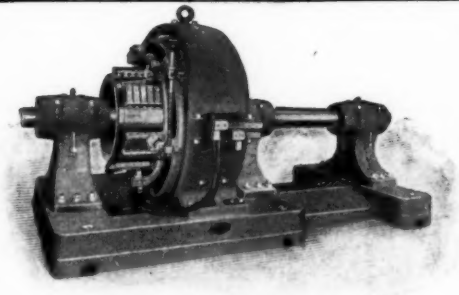
If You're Looking for "Gimcrack"



schemes and devices in a Planer, the Whitcomb isn't the Planer you're looking for. If you're looking for a thoroughly modern Planer, built on common sense lines and embodying every essential feature for the accurate and rapid production of good work, you need look no farther. The "talking points" of Whitcomb Planers are working points, every one of them, and they're set forth briefly but interestingly in our new Catalog, which comes promptly to you on request.

Whitcomb Mfg. Co., Builders, Worcester, Mass., U.S.A.

Selig, Sonnenthal & Co., London. G. Diechmann & Sohn, Berlin. Fenwick Freres & Co., Paris.



Modern High Grade

ELECTRICAL EQUIPMENTS.

The remarkable advantages of the Lundell "Split-Pole" Generator are fully described in our catalog No. 10013.

Correspondence invited.

SPRAGUE ELECTRIC COMPANY,

NEW YORK.

Chicago. Boston. St. Louis. Baltimore.

Inquiries for Machinery.

(141) Wanted, names and addresses of manufacturers of machines for making paper tags and automatically printing them in two colors as made.

(142) Manufacturers of machines for making lap-glued paper tubes ⅜ inch diameter by 4 inches long, and ½ inch diameter by 5 inches long; tubes to be made of bank-note paper .004 inch thick and rolled to about five thicknesses.

(143) Manufacturers of machines for making round wooden sticks of about the diameter of matches, used in the manufacture of Persian shades.

Personal.

Maurice E. White, for some time past foreman of the tool and die department of the Parish & Bingham Company, Cleveland, O., has lately been promoted to the position of superintendent.

Obituary.

The electrician, Zenobe Gramme, inventor of the armature which bears his name and forms the foundation of modern dynamos, who died, January 22, at Bois Colombes, near Paris, was a Belgian, but he left his country long ago, and most of his discoveries were made in France. He was born at Jehay-Badegnée, near Liège, of a poor family and became a carpenter. At Paris he worked his way against odds, having only his kitchen to use as a laboratory. In 1869 he took out his first patent, and thereafter never ceased to improve his inventions. At the Centennial Exhibition in Philadelphia he obtained a recognition which classed him among the most famous electricians of the world. His success and honors never spoiled his simplicity of character. He was often asked to become naturalized in France, but refused. His Belgian origin was almost forgotten in Belgium during his life, although there is a street in Liège that bears his name. Now that he is dead, his countrymen are with pride recalling his nativity.

The annual meeting of the stockholders of the Niles-Bement Pond Company was held February 5, at which the retiring board of directors was re-elected. Later in the day the board of directors organized by electing the retiring officers with the exception of F. B. Miles, who resigned as vice-president, and who is succeeded by T. T. Gaff. Mr. Miles is about to take a trip abroad, and it was stated that his resignation had no other significance. He remains a director.

The Norwegian Parliament has voted to establish a new technical school in Drontheim. There are already three in the country, one in Drontheim, founded in

1870; one in Christiania, founded in 1873, and in Bergen, founded in 1875. The industrial growth of the country has for some time rendered it evident that better facilities in this line are necessary.

New Catalogs.

The Norwood Bicycle Company, 62-66 Plum street, Cincinnati, O., has published a small catalog of machine handles, with prices. Size, standard, 3½x6 inches.

The C & C Electric Company, 143 Liberty street, New York, has published a catalog of its series-parallel system of control for electric motors. This is a new system, and a decidedly original one as applied to the purpose. It is designed especially for cylinder printing presses, but is applicable to large lathes and other machines. The pamphlet describes it fully. Size, 8x5½ inches.

The Gleason Tool Company, Rochester, N. Y., has published a book of illustrations of some of its gear planers. These pictures are proofs of fine half-tone cuts, loosely mounted on heavy pages of an appropriate material. There are also several large plates containing line drawings of mandrels used on the different machines, as well as some descriptive matter. The company manufactures gear planers in sizes 12 to 144 inches diameter, and gears from 1 inch to 16 feet diameter. Page size of this pamphlet, standard, 9x12 inches.

Manufacturers.

The Sans Pareil Bottle Company, Hartford City, Ind., is enlarging.

J. F. White has a site selected for a sugar beet factory at Moscow, N. Y.

Buildings are to be erected by the Saginaw (Mich.) Plate Glass Company.

The furniture factory of Messrs. Boak, at Hughesville, Pa., is being rebuilt.

Jacob Dime's Mallory Spinning Mill, Paterson, N. J., was burned January 26.

The Petaluma (Cal.) Incubator Company will erect a new 40x80-foot building.

I. C. Van Duzer and W. N. Auld will erect a furniture factory in Elberton, Ga.

The brick and tile factory of Wm. B. Henry, at Lancaster, O., was burned January 29.

The Oakland (R. I.) Worsted Company will, it is rumored, build another mill in the spring.

The Hoosier Dye Works, New Albany, Ind., will probably build a large factory in the spring.

Swift & Co. will, it is understood, put up a glue factory at their St. Joseph (Mo.) stock yards.

The Ripon (Wis.) Underwear Company's plant has been burned and probably will be rebuilt.

A ginning plant and compress will be erected at Mount Calm, Tex., by Robert Nickels.

The Fiberoid Company, manufacturer of collars, etc., Newburyport, Mass., will enlarge its plant.

The Adamson Mill Company, Cedartown, Ga., will erect a $100,000 cotton mill to make fine yarns.

Arbrogast Brothers, bottle manufacturers, near Six Mile Ferry, Pa., intend to build a new factory.

The Winchester Repeating Arms Company, New Haven, Conn., will enlarge its kiln-drying department.

(*Continued on next page.*)

FOR SALE!

We are desirous of installing several of our new

Gas Engines

where they may be seen, and we will make special discounts to introduce them. Our engines are the Vertical type 5 H. P. Single Cylinder and 10 H. P. Double Cylinder, of the latest and most modern design, highest efficiency and very economical in the amount of gas consumed.

This is an opportunity that should not be overlooked by anyone contemplating using gas engine motive power.

Illustrations and specifications will be furnished upon application.

Inquire of

Fred'k A. Verdon Company,
45 and 47 14th St., Hoboken, N. J.

VALUABLE BOOKS.

Mechanical Movements, Powers, Devices and Appliances,
By Gardner D. Hiscox. **Price, $3.00**

Horseless Vehicles, Automobiles and Motor Cycles
By Gardner D. Hiscox. **Price, $3.00**

Gas Engine Construction,
By Parsell & Weed. **Price, $2.50**

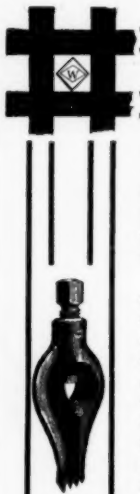
Liquid Air and the Liquefaction of Gases,
By Prof. T. O'Conor Sloane. **Price, $2.50**

Gas, Gasoline and Oil Engines,
By Gardner D. Hiscox. **Price, $2.50**

Complete Electrical Library (5 volumes),
By Prof. T O'Conor Sloane. **Price, $5.00**

FREE A special circular of any of these books sent on request. Our 96 page catalog of scientific and practical books, sent free to any address in the world on request.

NORMAN W. HENLEY & CO.,
PUBLISHERS,
15 Beekman St. NEW YORK.



13 sizes of two kinds in stock.

MOST "well-ordered" concerns number their orders. Where do you print this number? That's the rub! It's here, there and difficult to find. Steals invaluable business time.

What do you think of the corner in which U.S. is pleased to see the postage stamp? Of the corner that is close to your order date? Of the corner that catches quickly and naturally, the eye, when your requests are on file? What do you think of universality in details that affect the whole busy world? Of a concern that wishes to earn your esteem by strict rendering of these detail requests for

"number-on-bill,"
"number-on-pkge,"
"number-on-manifest,"
etc., etc.?

Have you free Red Book "J" on Drop-forgings?

J. H. Williams & Co.,
BROOKLYN, N.Y.

Draftsmen Wanted.

WE have positions open for capable, experienced Mechanical Draftsmen Our business is to assist Draftsmen and Engineers (technical men only) to secure positions when unemployed, and to better their positions when employed. Our business was established in 1893.

Address THE ENGINEERING AGENCY,
1005 Monadnock Block, CHICAGO.

"I've got a FREE SCHOLARSHIP."

Technical Education
BY MAIL.

To introduce the high standard of The American School of Correspondence, the Trustees have voted to award a limited number of Free Scholarships in Mechanical, Electrical, or Steam

Engineering,

including a complete course in Mechanical Drawing.

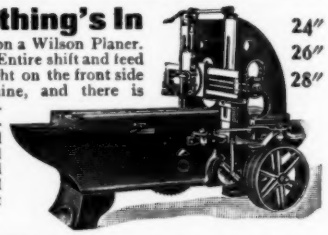
An excellent opportunity for private instruction in Mathematics, Mechanical Drawing or the sciences, under the direction of competent instructors.

Application blank on request.

American School of Correspondence
(Chartered by the Commonwealth of Massachusetts),
Boston, Mass., U. S. A.

Everything's In Sight on a Wilson Planer. Entire shift and feed rigging is right on the front side of the machine, and there is nothing hidden away inside the bed where 'twould be awkward to get at and liable to get out of order. Circular free.

24″
26″
28″



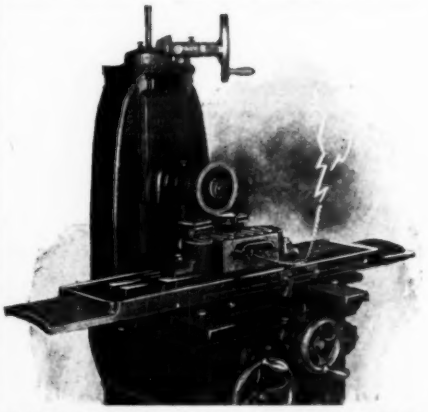
W. A. WILSON, 13 River St., Rochester, N.Y.

J. S. STILLWELL, M. Sc.
Industrial Chemist and Engineer.

Eleven years' practical experience as superintendent and expert in chemical and mechanical work.

SPECIALTY—OVERCOMING DIFFICULTIES IN THE WORKING OF NON-METALLIC MATERIALS. Processes worked out. Duplication of Products, Analyses.

156 BROADWAY, NEW YORK.



MAGNETIC CHUCKS
FOR
B. & S. Surface Grinders.

O. S. WALKER & CO., WORCESTER, MASS. U. S. A.